



**DRAFT 2013 SAMPLING AND ANALYSIS WORKPLAN FOR
BASELINE MONITORING OF THE SOUTHERN WHITEWATER RIVER WATERSHED**

PREPARED BY

**Timothy J. Beckman
Targeted Monitoring Section**

WATERSHED ASSESSMENT and PLANNING BRANCH
Indiana Department of Environmental Management (IDEM)
Office of Water Quality
100 North Senate Avenue
MC65-40-2 Shadeland
Indianapolis, Indiana 46204-2251

March 20, 2014

B-013-OWQ-W-XX-13-W-R0

This page is intended to be blank

SIGNATURE PAGE

2013 Sampling and Analysis Workplan for Baseline Monitoring of the Southern Whitewater River Watershed

Indiana Department of Environmental Management
Office of Water Quality
Watershed Assessment & Planning Branch
Indianapolis, Indiana

B-013-OWQ-W-XX-13-W-R0

Author(s) Signatures

Timothy J. Beckman Date 5/29/14
Timothy J. Beckman, Project Manager

Management Reviews and Approvals

Stacey Sobat Date 5/29/14
Stacey Sobat, Section Chief, Probabilistic Monitoring Section

Cyndi Wagner Date 5/29/14
Cyndi Wagner, Section Chief, Targeted Monitoring Section

Chuck Bell Date 6/2/14
Chuck Bell, Section Chief, WAPB QAM, Technical and Logistical Services Section

B. Elifritz Date 6/2/14
Bonny Elifritz, Section Chief, Watershed Planning Section

Ali Meils Date 5/29/14
Ali Meils, TMDL PM, Watershed Planning and Restoration Section

Timothy Bowren Date 5/29/14
Timothy Bowren, Project QAO, Technical and Logistical Services Section

Marylou Renshaw Date 6/2/14
Marylou Renshaw, Branch Chief, WAPB QAC
Watershed Assessment and Planning Branch

Michael F. Spinar Date 6/3/14
Michael Spinar, Quality Improvement Program Staff, Office of Compliance Support

This page is intended to be blank

FOREWORD

Work Plan versus QAPP:

This Sampling and Analysis Work Plan is an extension of the existing Watershed Assessment and Planning Branch, October 2004 “*Quality Assurance Project Plan (QAPP) for Indiana Surface Water Quality Monitoring and Total Maximum Daily Load (TMDL) Program*” and is intended to serve as a link to the existing program QAPP as well as function as an project independent QAPP. Per the U.S. EPA QAPP guidance, this Work Plan establishes criteria and specifications pertaining to a specific water quality monitoring project that are usually described in the following four groups (phases) or sections as QAPP elements:

Phase A. Project Management/Planning

The plan documents project history and objectives, and establishes Data Quality Objectives (DQOs).

Phase B. Measurement/Data Acquisition

The plan describes sampling procedures, analytical methods, sample and data acquisition requirements, and the quality control measures specific to the project.

Phase C. Assessment/Oversight

The plan identifies the key elements of external and internal checks, audits, peer reviews, Data Quality Assessments (DQAs), and the preparation of Quality Assurance/Quality Control (QA/QC) Review Reports for management.

Phase D. Data Validation and Usability

The plan describes data handling and associated QA/QC activities including QA/QC Review Reports.

Table of Contents

(QAPP Element A2)

Table of Contents

SIGNATURE PAGE	i
List of Attachments.....	vi
List of Figures.....	vi
LIST OF ACRONYMS	vii
Definitions:	viii
Baseline Monitoring of the Southern Whitewater River Watershed Objective	1
I. PROJECT MANAGEMENT/PLANNING.....	2
(QAPP Elements A4, A5, A6, A7, A8)	2
Project/Task Organization and Schedule: (QAPP Element A4)	2
Background and Project/Task Description: (QAPP Elements A5, A6)	3
Data Quality Objectives (DQOs): (QAPP Element A7).....	3
1. State the Problem	3
2. Identify the Decision	3
3. Identify the Inputs to the Decision.....	5
4. Define the Boundaries of the Study	5
5. Develop a Decision Rule	9
6. Specify Tolerable Limits on Decision Errors	9
7. Optimize the Design for Obtaining Data	10
Training and Staffing Requirements: (QAPP Element A8)	10
II. MEASUREMENT/DATA ACQUISITION.....	11
Sampling Process Design/ Methods, Sample Handling and Custody	11
(QAPP Elements B1, B2, B3, B4, B5, B6, B7)	11
Sampling Sites/Sampling Design: (QAPP Element B1).....	11
Sampling Methods and Sample Handling: (QAPP Elements B2, B3)	12
Field Parameter Measurements	14
Analytical Methods: (QAPP Element B4)	15
Laboratory Procedure for E. coli Measurements:.....	15
Nutrient and General Chemistry Parameters Measurements:	15
Field Parameters Measurements:.....	16
Quality Control and Custody Requirements: (QAPP Element B5)	18
Field Instrument Testing and Calibrations: (QAPP Elements B6, B7)	18
III. ASSESSMENT/OVERSIGHT: (QAPP Elements C1, C2)	20
Data Quality Assessment Levels.....	20
IV. DATA VALIDATION AND USABILITY: (QAPP Element D1, D2).....	22
Quality Assurance/Data Qualifiers and Flags:.....	22
Data Usability:	23
Laboratory and Estimated Cost:.....	23
Reference Manuals and Personnel Safety:	24
REFERENCES:.....	26
DISTRIBUTION LIST:	31

This page is intended to be blank

List of Attachments

Attachment 1: Modified Geometric Design Steps for Baseline Studies	32
Attachment 2: Blank Stream Sampling Field Data Sheet.....	37
Attachment 3: Blank OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index) Form	38
Attachment 4: Macroinvertebrate Header Form.....	40
Attachment 5: Fish Collection Data Sheet	41
Attachment 6: Chain of Custody Form	42
Attachment 7: Sample Analysis Request Form	43
Attachment 8: Biological Samples Chain of Custody Form.....	44

List of Figures

Figure 1. Southern Whitewater River Watershed Baseline Monitoring Sampling Area	6
---	---

List of Tables

Table 1. Water Quality Criteria (327 IAC 2-1-6).....	4
Table 2. Sampling Locations for Baseline Monitoring of the Southern Whitewater River Watershed	6
Table 3. <i>E. coli</i> , Nutrient and General Chemistry Parameters Test Methods	15
Table 4. Field Parameters Test Methods.....	17
Table 5. Data Qualifiers and Flags	22

LIST OF ACRONYMS

ADP:	Acoustic Doppler Profiler
ADV:	Acoustic Doppler Velocimeter
AIMS:	Assessment Information Management System
AAC:	Acute Aquatic Criterion
CALM:	Consolidated Assessment Listing Methodology
CCC:	Criterion Continuous Concentration
CFR:	Code of Federal Regulations
CFU:	Colony Forming Units
CLP:	Contract Laboratory Program
COD:	Chemical Oxygen Demand
CPR:	Cardio-Pulmonary Resuscitation
CRQL:	Contract Required Quantification Limit
DO:	Dissolved Oxygen
DQA:	Data Quality Assessment
DQO:	Data Quality Objective
<i>E. coli:</i>	<i>Escherichia coli</i>
EPA:	Environmental Protection Agency
GPS:	Global Positioning System
HUC:	Hydrologic Unit Code
IAC:	Indiana Administrative Code
IBC:	Impaired Biotic Community
IBI:	Index of Biotic Integrity
IDEM:	Indiana Department of Environmental Management
MDL:	Method Detection Limit
mg/L:	Milligram per liter
MHAB:	Multi-habitat
mL:	Milliliter
MPN:	Most Probable Number
MS/MSD:	Matrix Spike/Matrix Spike Duplicate
NTU:	Nephelometric Turbidity Unit(s)
OWQ:	Office of Water Quality
PFD:	Personal Flootation Device
PM:	Project Manager
PPE:	Personal Protective Equipment
QAC:	Quality Assurance Coordinator
QAM:	Quality Assurance Manager
QAO:	Quality Assurance Officer
QA/QC:	Quality Assurance/Quality Control
QAPP:	Quality Assurance Project Plan
QHEI:	Qualitative Habitat Evaluation Index
RFP:	Request for Proposals
RL:	Reporting Limit
RPD:	Relative Percent Difference

SM:	Standard Method
SOP:	Standard Operating Procedures
SU:	Standard Units
TKN:	Total Kjeldahl Nitrogen
TMDL:	Total Maximum Daily Load
TDS:	Total Dissolved Solids
TOC:	Total Organic Carbon
TP:	Total Phosphorus
TS:	Total Solids
TSS:	Total Suspended Solids
µS/cm	Micro Siemens per Centimeter
U.S.:	United States
WAPB:	Watershed Assessment and Planning Branch

Definitions:

Elutriate	To purify, separate, or remove lighter or finer particles by washing, decanting, and settling.
Geometric site	Sampling site chosen according to its drainage area within a watershed.
One (1) minute kick sample	A stationary method of sampling that is accomplished using a box-shaped net comprised of canvas bottom and/or sides and 504µ nylon mesh back. The designated area is sampled for one minute.
Pour point	The outlet of a subwatershed or the common point where all the water flows out of any given subwatershed.
Targeted site	A sampling site intentionally selected based on specific monitoring objectives or decisions to be made.

This page is intended to be blank

Baseline Monitoring of the Southern Whitewater River Watershed Objective

Baseline monitoring is an intensive targeted watershed design that characterizes the current condition of an individual watershed. This type of monitoring provides valuable data for the purposes of TMDL development, watershed planning, and allows for future comparisons to evaluate changes in the water quality within the watershed(s) studied. Selecting a spatial monitoring design with sufficient sampling density to accurately characterize water quality conditions is a critical step in the process of developing an adequate local scale watershed study.

The Indiana Department Environmental Management (IDEM) has selected the Southern Whitewater River Watershed for this water quality study and TMDL development. Sample sites were chosen using a modified geometric site selection and targeted site selection in order to get the necessary spatial representation of the entire study area. Geometric sites within this watershed were selected based on a geometric progression of drainage areas starting with the area at the mouth of the main stem stream and working upstream through the tributaries to the headwaters. Monitoring sites were then located to the nearest bridge. A more complete description of the modified geometric site selection process is included as attachment 1. Targeted sample sites were chosen at the nearest bridge to the pour point (the lowest point in the basin through which all water flows) of each 12-digit Hydrologic Unit Code (HUC) in the watershed, or chosen to characterize sources for TMDL development.

It is anticipated that the water quality data collected through this monitoring will provide the information to the TMDL program and local water quality managers that is needed to characterize the watershed, identify sources of impairment, designate critical areas, and enable users to make valid and informed watershed decisions. In addition, this project, by design, will add additional stream reaches for assessment of aquatic life and recreational use support.

The draft 2012 303(d) List of Impaired Waters submitted to the U.S. EPA (IDEM 2012a) details the following impairments of the approximately 293 miles of the Southern Whitewater River Watershed:

- *Escherichia coli* (*E. coli*), 232 miles
- Dissolved Oxygen (DO), 125 miles
- Total Mercury, 46 miles
- Polychlorinated Biphenyls (PCBs) in fish tissue, 62 miles

The data used to complete assessments in this watershed was collected by IDEM through multiple projects in the Fixed Station Monitoring, Probabilistic Monitoring and Fish Tissues Contaminants Monitoring program areas conducted between 1994 and 2013.

I. PROJECT MANAGEMENT/PLANNING

(QAPP Elements A4, A5, A6, A7, A8)

Project/Task Organization and Schedule: (QAPP Element A4)

The main objective of this project is to provide a comprehensive assessment of the streams in the Southern Whitewater River Watershed for their ability to support aquatic life use and recreational use. Sampling for this project will begin in November 2013 and end in October 2014. Chemical, physical, and biological parameters will be collected for the project.

Time frames for sampling activities include:

Site reconnaissance activities will be completed in September 2013. Reconnaissance activities will be conducted in the office and through physical site visits if needed.

Water chemistry will be sampled monthly during the recreational season, defined as April through October [327 Indiana Administrative Code (IAC) 2-1-6] (2013) at all sites in the watershed. The sites at the pour point of each 12-digit HUC will be sampled monthly for one year. The first sampling event will begin in November 2013 and the last will conclude in October 2014.

Biological sampling activities will begin in the summer of 2014 and end no later than October 17, 2014. The basin will be sampled for fish community, macroinvertebrate community, and habitat quality at all sites in the watershed.

Bacteriological sampling will take place at all sites in the watershed during the recreational season. All sites will be sampled monthly for *Escherichia coli* (*E. coli*) from June through October of 2014. In addition, *E. coli* samples will be collected five times from each site at equally spaced intervals over a 30-day period during the months of April and May 2014 to determine a geometric mean to assess compliance with WQS.

Stream flow will be quantified at the pour point of each 12-digit HUC during the monthly water chemistry sampling for one year. The first event will begin in November 2014 and conclude in October 2014. Barring any hazardous weather conditions or unexpected physical barriers to access the site, samples will be collected for physical, chemical, and bacteriological parameters as well as biological communities. Sample collections for fish community and macroinvertebrates may be postponed due to scouring of the stream substrate or in-stream cover caused by a high water event, which would result in non-representative samples.

Background and Project/Task Description: (QAPP Elements A5, A6)

The Baseline Monitoring Program was instituted to assist in characterizing existing conditions in watersheds throughout the state. The Southern Whitewater River Watershed baseline data set will be utilized by the TMDL program and shared with local watershed groups and any other parties interested in the watershed. This monitoring will provide data for TMDL development and watershed planning uses and will aid in the evaluation of future changes within the basin. For this study, the following media will be used for assessment purposes: Water chemistry, stream flow, bacteriological contamination in the form of *E. coli*, fish community, macroinvertebrate assemblages, and habitat evaluations.

Data Quality Objectives (DQOs): (QAPP Element A7)

The Data Quality Objective (DQO) process (U.S. EPA 2000) is a planning tool for data collection activities. It provides a basis for balancing decision uncertainty with available resources. The DQO is required for all significant data collection efforts for a project. It is a seven step systematic planning process used to clarify study objectives, define the appropriate types of data, and establish decision criteria on which to base the final use of the data. The DQO for the Baseline Monitoring of the Southern Whitewater River Watershed is identified in the following seven steps:

1. State the Problem

An intensive targeted watershed design of the Southern Whitewater River Watershed is needed in order to develop a TMDL and fully characterize the current water quality condition of the watershed. Indiana is required to assess all waters of the state to determine their designated use attainment status. "Surface waters of the state are designated for full-body contact recreation and will be capable of supporting a well-balanced, warm water aquatic community" [327 IAC 2-1-3] (2013). This project will gather stream flow, water chemistry, bacteriological, biological (fish and macroinvertebrates), and habitat data for the purpose of assessing the designated use attainment status of the Southern Whitewater River Watershed.

2. Identify the Decision

The main objective of this study is to fully assess whether the surface waters in this watershed are fully supporting or non-supporting for aquatic life use and recreational use. All sites will be sampled for concentrations of physical, chemical, and biological parameters and evaluated as "supporting" or "non-supporting" when compared with

water quality criteria found in the Indiana Administrative Code (IAC, updated February 12, 2014) and included in Table 1 [327 IAC 2-1-6].

In addition to the physical, chemical, and bacteriological criteria listed in Table 1, data for several nutrient parameters will be evaluated with the benchmarks described below. Assuming a minimum of three sampling events, if two or more of the conditions below are met on the same date, the waterbody will be classified as non-supporting due to nutrients.

Total Phosphorus (TP): one or more measurements >0.3 mg/L

Nitrogen (measured as Nitrate+Nitrite): one or more measurements >10.0 mg/L

Dissolved Oxygen (DO): <4.0 mg/L or measurements consistently at or close to the standard, range 4.0-5.0 mg/L or >12.0 mg/L

pH: >9.0 Standard Units (SU) or measurements consistently at or close to the standard, range 8.7-9.0 SU

Biological Criteria:

Indiana narrative biological criteria located at 327 IAC 2-1-3 states that “all waters, except those designated as limited use, will be capable of supporting a well-balanced, warm water aquatic community.” The water quality standards define a “well-balanced aquatic community” at 327 IAC 2-1-9, as “an aquatic community which is diverse in species composition, contains several different trophic levels, and is not composed mainly of strictly pollution tolerant species”. An interpretation or translation of narrative biological criteria into numeric criteria would be as follows: A stream segment is non-supporting for aquatic life use when the monitored fish or macroinvertebrate community receives an Index of Biotic Integrity (IBI) score of less than or equal to 35 which is considered “Poor” or “Very Poor” (IDEM 2012b).

Table 1. Water Quality Criteria 327 IAC 2-1-6

Parameters	Water Quality Criteria	Criterion Type
<i>E. coli</i> April-October (Recreational season)	125 MPN/100 mL	5-Sample Geometric Mean
	235 MPN/100 mL	Single Sample Maximum
Total Ammonia (NH ₃ -N)	Calculated Based on pH and Temperature ¹	Single Sample Maximum

¹ 327 IAC 2-1-6 (b)(5)

Parameters	Water Quality Criteria	Criterion Type
Nitrate+Nitrite-Nitrogen	10 mg/L	Public Water Supply ²
Dissolved Oxygen	At least 5.0 mg/L (Down State) ³	Daily Average
	Not less than 4.0 mg/L at any time	Not to exceed limit
pH	6.0 - 9.0 ⁴	Unless correlated with photosynthetic activity
Temperature	Varies Monthly ⁵	Not to exceed limit
Chloride	Varies based on hardness and sulfate values ⁶	AAC, CCC

3. Identify the Inputs to the Decision

Grab samples (IDEM, 2002) will be collected at the surface water sampling locations for *E. coli* and the parameters listed in Table 3. Field measurements (Table 4) will be conducted at each site during each sampling event. Visual field observations will include weather conditions, stream conditions, and percent stream canopy at each sampling location. All bacteriological samples collected will be analyzed for *E. coli* using the Idexx Colilert Enzyme Substrate Standard Method SM9223B (Clesceri et al., 1998). Surface water samples will be collected monthly and processed and analyzed by the Indiana State Department of Health (ISDH) Environmental Lab using the analytical methods listed in Table 3. Stream discharge will also be measured or estimated monthly at pour points to determine total stream loadings. A fish and macroinvertebrate community sample will be collected once at each site with a corresponding habitat evaluation.

4. Define the Boundaries of the Study

The Southern Whitewater River Watershed drains 411 square miles and is situated primarily in Franklin County with smaller portions located in the counties of Rush, Decatur, Fayette, Ripley, and Dearborn. The largest land uses in the watershed are approximately 50% forested, 29% agriculture, and 12% pasture/hay. See Figure 1 for the Southern Whitewater River Watershed Baseline Monitoring sampling area and Table 2 for the list of sampling locations.

² 327 IAC 2-1-9 (45)

³ 327 IAC 2-1-6 (b)(3)

⁴ 327 IAC 2-1-6 (b)(2)

⁵ 327 IAC 2-1-6 (b)(4)(D)

⁶ 327 IAC 2-1-6 (a)(5)

Figure 1. Southern Whitewater River Watershed Baseline Monitoring Sampling Area

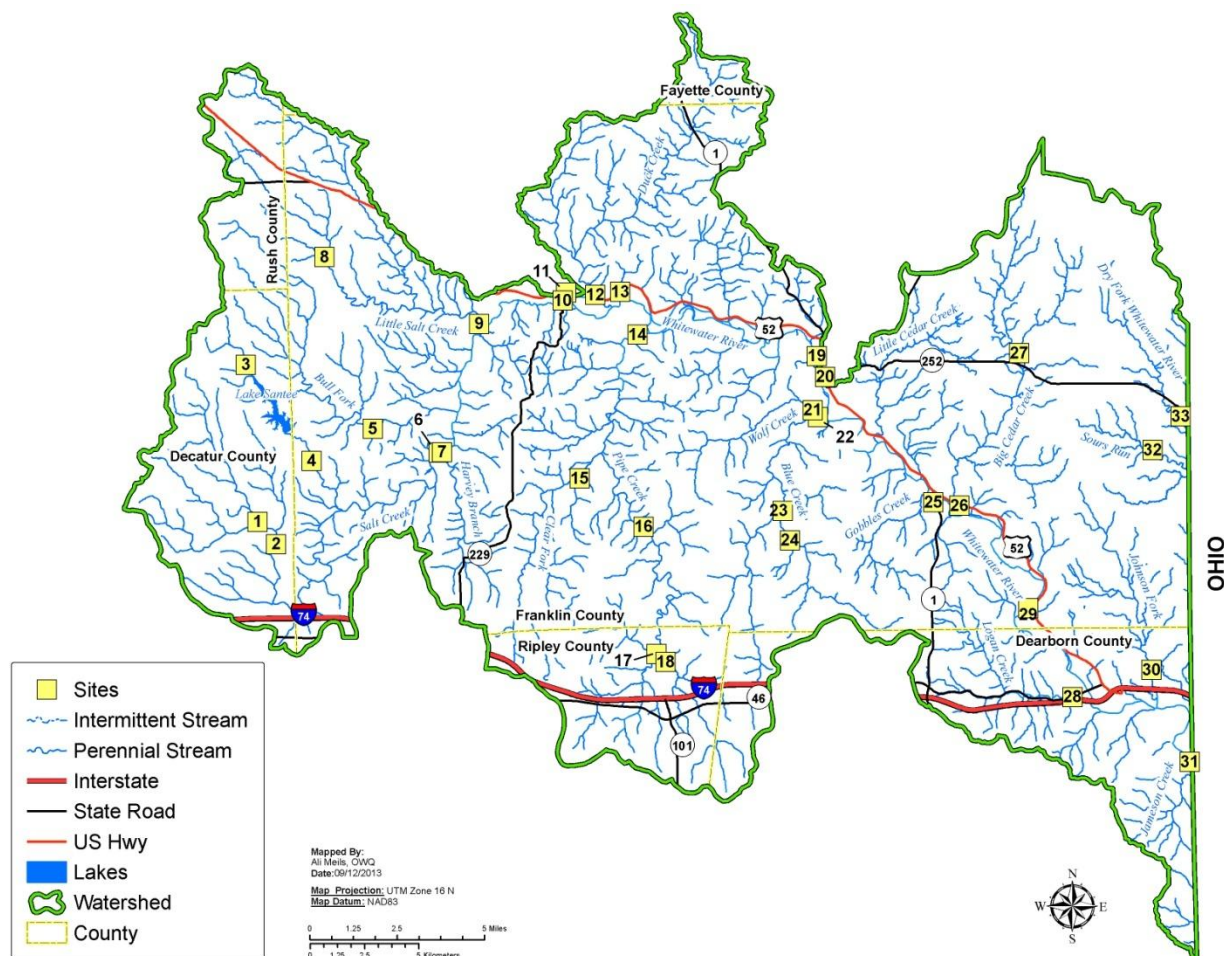


Table 2. Sampling Locations for Baseline Monitoring of the Southern Whitewater River Watershed

Site #	AIMS Site #	Stream Name	Location	County	Latitude (Decimal Degree)	Longitude (Decimal Degree)
14T-001	GMW050-0023	Tributary of Salt Creek	CR 150 N	Decatur	39.357061	-85.315868
14T-002	GMW-05-0006	Salt Creek	CR 50 N	Decatur	39.347695	-85.306373

Site #	AIMS Site #	Stream Name	Location	County	Latitude (Decimal Degree)	Longitude (Decimal Degree)
14T-003	GMW-05-0014	Righthand Fork Salt Creek	E CR 550 N	Decatur	39.422252	-85.320613
14T-004	GMW-05-0011	Righthand Fork Salt Creek	Hamburg Rd	Franklin	39.381930	-85.286354
14T-005	GMW-05-0009	Bull Fork	Bullfork Rd	Franklin	39.394734	-85.253435
14T-006	GMW-05-0007	Salt Creek	Rail Fence Rd	Franklin	39.384362	-85.218365
14T-007	GMW-05-0012	Harvey Branch	Rail Fence Rd	Franklin	39.384462	-85.216536
14T-008	GMW-05-0015	South Fork Little Salt Creek	Chapel Rd	Franklin	39.466287	-85.277402
14T-009	GMW-05-0008	Little Salt Creek	Stipps Hill Rd	Franklin	39.437368	-85.195434
14T-010	GMW-05-0010	Salt Creek	SR 229	Franklin	39.446263	-85.150465
14T-011	GMW-04-0018	Whitewater River	US 52	Franklin	39.449672	-85.148462
14T-012	GMW-06-0019	Duck Creek	US 52	Franklin	39.448420	-85.132976
14T-013	GMW-06-0022	Whitewater Canal	Park Ave at Whitewater Canal State Historic Site	Franklin	39.449659	-85.119581
14T-014	GMW-06-0015	Pipe Creek	Silver Creek Rd	Franklin	39.431516	-85.110791
14T-015	GMW-06-0013	Clear Fork	Schwegman Rd	Franklin	39.372458	-85.143341

Site #	AIMS Site #	Stream Name	Location	County	Latitude (Decimal Degree)	Longitude (Decimal Degree)
14T-016	GMW-06-0020	Pipe Creek	St Marys Rd	Franklin	39.351869	-85.109727
14T-017	GMW-06-0014	Tributary of Pipe Creek	St Marys Rd	Ripley	39.299046	-85.104299
14T-018	GMW060-0027	Pipe Creek	Pipe Creek Rd	Ripley	39.295639	-85.099596
14T-019	GMW-06-0012	Whitewater River	St Marys Rd	Franklin	39.421072	-85.015236
14T-020	GMW-07-0026	East Fork Whitewater River	US 52	Franklin	39.412373	-85.010942
14T-021	GMW-08-0026	Wolf Creek	Blue Creek Rd	Franklin	39.398714	-85.018113
14T-022	GMW080-0003	Blue Creek	Highland Center Rd	Franklin	39.395833	-85.015278
14T-023	GMW-08-0014	Blue Creek	Blue Creek Rd	Franklin	39.357202	-85.035169
14T-024	GMW-08-0022	East Fork Blue Creek	Blue Creek Rd	Franklin	39.344938	-85.031634
14T-025	GMW-08-0015	Whitewater River	SR 1	Franklin	39.359380	-84.954709
14T-026	GMW-08-0016	Big Cedar Creek	US 52	Franklin	39.357724	-84.940650
14T-027	GMW-08-0024	Big Cedar Creek	Big Cedar Rd	Franklin	39.420338	-84.906855
14T-028	GMW-08-0019	Logan Creek	SR 46	Dearborn	39.277358	-84.882803
14T-029	GMW-08-0030	Whitewater River	St Peters Rd	Franklin	39.314457	-84.905643

Site #	AIMS Site #	Stream Name	Location	County	Latitude (Decimal Degree)	Longitude (Decimal Degree)
14T-030	GMW-08-0018	Johnson Fork	Johnson Fork Rd	Dearborn	39.287833	-84.840265
14T-031	GMW-08-0021	Whitewater River	Jamison Rd	Dearborn	39.249309	-84.820915
14T-032	GMW-08-0027	Sours Run	Drewersburg Rd	Franklin	39.378871	-84.836775
14T-033	GMW-08-0020	Dry Fork Whitewater River	Dickson Rd	Franklin	39.392580	-84.821300

5. Develop a Decision Rule

For assessment purposes in the Indiana Integrated Report (IDEM 2012b), recreational use attainment decisions will be based on bacteriological criteria developed to protect primary contact recreational activities [327 IAC 2-1-6] (2013). Aquatic life use support decisions will include independent evaluations of biological and chemical data as outlined in Indiana's 2012 Consolidated Assessment and Listing Methodology (CALM, IDEM 2012b)

6. Specify Tolerable Limits on Decision Errors

Sampling design error is minimized by utilizing a comprehensive checklist of informational sources, evaluation of historical information, and a thorough watershed pre-survey. This sampling design has been formulated to address data deficiencies and render the optimum amount of data needed to fill gaps in the decision process.

Good quality data are essential for minimizing decision error. By minimizing both sampling design error and measurement error for physical and biological parameters, more confidence can be placed in the conclusions drawn on the stressors and sources affecting the water quality in the study area.

Site specific aquatic life use and recreational use assessments include program specific controls to minimize the introduction of errors. These controls include water chemistry and bacteriological blanks and duplicates, biological site revisits or duplicates, and laboratory controls through verification of species identifications. Field Procedure Manuals (IDEM 2002; OHEPA 2006) and Standard Operating Procedures (IDEM

1992b, 1992c, 1992d, 1992e, 2010a) dictate consistent and proven techniques for sample collection to assure representative samples and minimize measurement error.

The QA/QC process detects deficiencies in the data collection as set forth in the IDEM QAPP, Section D3, for the Indiana Surface Water Quality Monitoring Program (IDEM 2004). The QAPP requires all contract laboratories to adhere to rigorous standards during sample analyses and to provide good quality usable data. Chemists within the Watershed Assessment and Planning Branch (WAPB) review the laboratory analytical results for quality assurance. Any data which is “Rejected” due to analytical problems or errors will not be used for water quality assessment decisions. Any data flagged as “Estimated” may be used on a case by case basis.

7. Optimize the Design for Obtaining Data

A modified geometric design site selection process is used in this study in order to get the necessary spatial representation of the entire study area. Sites within this watershed have been selected based on a geometric progression of drainage areas and then located to the nearest bridge. Sample sites at road crossings will allow for more efficient sampling of the watershed.

Training and Staffing Requirements: (QAPP Element A8)

The WAPB uses many Standard Operating Procedures (SOPs), so any new staff member must be trained by experienced IDEM professionals on how to operate field and laboratory equipment for the collection of chemical, physical, and biological parameters as well as perform required QA/QC procedures (information about SOPs is given in Sections II: MEASUREMENT/DATA ACQUISITION and IV: DATA VALIDATION and USABILITY). IDEM Staff that will be involved in the Project will be required to review relevant field and laboratory SOP's before sampling begins.

The fish or macroinvertebrate community team leader must have a Bachelor of Science degree with a concentration in biology or other closely related area and at least one year of experience with the sampling methodology and taxonomy of the aquatic communities in the region. Prior to conducting electrofishing for fish community sampling, crew members should review the Principles and Techniques of Electrofishing correspondence course provided by the U.S. Fish & Wildlife Service, National Conservation Training Center as well as test equipment and conduct field training with less experienced crew members. The field crew leader will be responsible for completion of field data sheets, taxonomic accuracy, sampling efficiency and representation, and voucher specimen tracking.

Staff from the Technical and Logistical Services Section will assist with laboratory work requests and review laboratory data for adherence to QA/QC requirements specified in analytical test methods, contract requirements, and the IDEM QAPP for the Indiana Surface Water Quality Monitoring Program (IDEM 2004) as well as importing electronic data into the Assessment Information Management System (AIMSII) database which is used by the WAPB. The assigned QA Officer will create QA/QC review reports for each laboratory. Staff will oversee data entry into AIMSII of information collected in the field and laboratory as well as perform data QA/QC review for accuracy and completeness.

II. MEASUREMENT/DATA ACQUISITION

Sampling Process Design/ Methods, Sample Handling and Custody (QAPP Elements B1, B2, B3, B4, B5, B6, B7)

Sampling Sites/Sampling Design: (QAPP Element B1)

The proposed site locations are chosen using a modified geometric and targeted design process as described previously in the “Baseline Monitoring of the Southern Whitewater River Watershed Objective” section of this workplan.

Site reconnaissance activities are conducted in-house and through physical site visits. In-house activities include preparation and review of site maps and aerial photographs. Physical site visits include verification of accessibility, safety considerations, equipment needed to properly sample the site, and property owner consultations, if required. Final coordinates for each site will be determined during the physical site visits or at the beginning of the sampling phase of this project using a Trimble Juno TM SB Global Positioning System (GPS) with an accuracy of one to three meters. These coordinates will be entered into the AIMS II database.

Table 2 provides a list of the selected sampling sites with the stream name, AIMS site number, County name, and the latitude and longitude of each site. The map at Figure 1 paired with that table provides a good overview of the various sampling site locations.

Sampling Methods and Sample Handling: (QAPP Elements B2, B3)

Water Chemistry

One team of two staff will collect grab water chemistry samples and record physical site observations on the stream sampling field data sheet (Attachment 3), during monthly sampling events. All water chemistry sampling will adhere to the Water Quality Surveys Section Field Procedure Manual, Section 2.1 (IDEM 2002).

Bacteriological Sampling

The bacteriological sampling will be conducted by one team consisting of one or two staff. Samples will be processed in an IDEM *E. coli* Mobile Laboratory equipped with all materials and equipment necessary for the Colilert® Test Method. Per Element A4 Project Organization and Schedule (above), the expected time frame for bacteriological sampling will be April through October of 2014. Staff will collect the samples in a 120 mL pre-sterilized wide mouth container from the center of flow if stream is wadeable or from the shoreline using a pole sampler if the stream is not wadeable. All samples will be consistently labeled, cooled, and held at a temperature less than 10°C during transport. All *E. coli* samples will be collected on a schedule such that any sampling crew can deliver them to the IDEM *E. coli* Mobile Laboratory for analyses within the bacteriological holding time of six hours.

The IDEM *E. coli* Mobile Laboratory is used in this project to facilitate *E. coli* testing by eliminating the necessity of transporting samples to distant contract laboratories within a six-hour holding time. The *E. coli* Mobile Laboratory (Van) provides work space containing storage for samples, supplies for Colilert® Quanti-tray testing, and all equipment needed for collecting, preparing, incubating, and analyzing results. All supplies will be obtained from IDEXX Laboratories, Inc., Westbrook, Maine.

Fish Community Sampling

The fish community sampling will be completed by teams of three to five staff. Sampling will be performed using various standardized electrofishing methodologies depending on stream size and site accessibility. Fish assemblage assessments will be performed in a sampling reach of 15 times the average wetted width, with a minimum reach of 50 meters and a maximum reach of 500 meters (Simon 1997; Simon and Dufour 1998, 2005; U.S. EPA 1995). An attempt will be made to sample all habitat types available within the sample reach to ensure adequate representation of the fish community present at the time of the sampling event. The possible list of electrofishers

to be utilized include: the Smith-Root LR-24 or LR-20 Series backpack electrofishers, the Smith-Root model 1.5KVA electrofishing system, the Smith-Root model 2.5 Generator Powered Pulsator electrofisher with RCB-6B junction box and rat-tail cathode cable assembled in a canoe (if parts of the stream are not wadeable, the system may require the use of a dropper boom array outfitted in a canoe or possibly a 12 foot Loweline™ boat), or for non-wadeable sites the Smith-Root model 6a electrofisher assembled in a 16 foot Loweline™ boat (IDEM 1992a, 1992b, 1992c, 1992d).

Fish will be collected using dip nets with fiberglass handles and netting of 1/8-inch bag mesh. Fish collected in the sampling reach will be sorted by species into baskets and buckets. Young-of-the year fish less than 20 millimeters (mm) total length, will not be retained in the community sample (Simon 1990; U.S. EPA 1995).

Prior to processing fish specimens and completion of the fish collection datasheet (Attachment 6), one to two individuals per species will be preserved in 3.7% formaldehyde solution for future reference if there are more than 10 individuals for that species collected in the sampling reach, the specimens can be positively identified, and the individuals for preservation are small enough to fit in a 2000 mL jar. If however, there are few individuals captured or the specimens are too large to preserve, a photo of key characteristics will be taken for later examination. Taxonomic characteristics for possible species encountered in the basin of interest will be reviewed prior to field work. Fish specimens should also be preserved if they cannot be positively identified in the field (especially those that co-occur like the striped and common shiner), individuals that appear to be hybrids or have anomalies, as well as dead specimens that are taxonomically valuable for un-described taxa (like the new stoneroller, red shiner, or jade darter), life history studies, or research projects.

Data will be recorded for non-preserved fish on the fish collection datasheet (Attachment 6) consisting of the following: number of individuals, minimum and maximum total length (mm), mass weight in grams (g), and number of individuals with deformities, eroded fins, lesions, tumors, and other anomalies. Once the data have been recorded, specimens will be released within the sampling reach if possible. Data will be recorded for preserved fish specimens following taxonomic identification in the laboratory.

Macroinvertebrate Sampling

The macroinvertebrate community sampling will be conducted by crews of two to three staff. Samples are collected using a modification of the U.S. Environmental Protection Agency (USEPA) Rapid Bioassessment Protocol multi-habitat (MHAB) approach using a D-frame dipnet (Barbour et al. 1999; IDEM 2010a; Klemm et al. 1990; Plafkin et al.

1989). The IDEM MHAB approach is composed of a 1-minute "kick" sample within a riffle or run (collected by disturbing 1m² of stream bottom substrate and collecting the dislodged macroinvertebrates within the dipnet) and a 50 meter "sweep" sample of shoreline habitats (collected by disturbing habitats such as emergent vegetation, coarse particulate organic matter, depositional zones, logs and sticks and collecting the dislodged macroinvertebrates within the dipnet). The 50-meter length of riparian corridor that is sampled at each site will be defined using a rangefinder or GPS unit. If the stream is too deep to wade, a boat will be used to sample the 50- meter zone along the shoreline that has the best available habitat. The 1-minute "kick" and 50- meter "sweep" samples are combined in a bucket of water which will be elutriated through a U.S. standard number 35 (500 µm) sieve a minimum of five times so that all rocks, gravel, sand and large pieces of organic debris are removed from the sample. The remaining sample is then transferred from the sieve to a white plastic tray where the collector (while still on-site) will conduct a 15-minute pick of macroinvertebrates at a single organism rate with an effort to pick for maximum organism diversity through turning and examination of the entire sample in the tray. The resulting picked sample will be preserved in 70% ethanol and returned to the laboratory for identification at the lowest practical taxonomic level (usually genus or species level, if possible) and evaluated using the multi-habitat macroinvertebrate index of biotic integrity (mIBI). A Qualitative Habitat Evaluation Index (QHEI) multi-habitat scoring sheet (Attachment 4) will also be completed for the sample while on-site. These lowest taxa samples will be evaluated using the multi-habitat IBI. A completed Biological Samples chain of custody form (Attachment 9) accompanies the samples through the identification process.

Habitat Assessments

Habitat assessments will be completed immediately following macroinvertebrate and fish community sample collections at each site using the Ohio Environmental Protection Agency Qualitative Habitat Evaluation Index (QHEI), 2006 edition (OHEPA 2006; Rankin 1995).

Field Parameter Measurements

DO, pH, water temperature, specific conductance, turbidity, and DO percent saturation will be measured with a datasonde during each sampling event (IDEM 2002). Measurement procedures and operation of the datasonde shall be performed according to the manufacturers' operating manuals (Hydrolab Corporation 2002; YSI 2002) and Sections 2.10 – 2.13 of the Water Quality Surveys Section Field Procedure Manual (IDEM 2002).

Flow Measurements

Flow measurements are to be taken by the water chemistry crew at the pour point sites during each sampling run using the SonTek Acoustic Doppler Profiler (ADP) at non-wadeable sites and the FlowTracker Handheld Acoustic Doppler Velocimeter (ADV) ® at the wadeable sites. Procedures shall be according to Section 2.6.5 of the Surveys Section Field Procedure Manual (IDEM 2002) and the manufacturers' operating manuals. (SonTek/YSI Inc 2007; 2001)

Analytical Methods: (QAPP Element B4)

Laboratory Procedure for *E. coli* Measurements:

At the end of each sampling run and while still in the field, water samples are processed and analyzed for *E. coli* within the six-hour holding time for collection and transportation, and the two-hour holding time for sample processing. All waters sampled are processed and analyzed for *E. coli* in the IDEM *E. coli* Mobile Laboratory or IDEM Shadeland laboratory, which is equipped with required materials and equipment necessary for the Idexx™ Colilert Test. The Colilert Test is a multiple-tube Enzyme Substrate Standard Method SM-9223 B (Clesceri et al., 1998). The *E.coli* test method and quantification limit are identified below in Table 3.

Nutrient and General Chemistry Parameters' Measurements:

Nutrient and general chemistry measurement analysis is performed at the ISDH Environmental Lab in accordance with pre-approved test methods and allotted time frames. The nutrient and general chemistry parameters and their respective test methods and quantification limits are identified below in Table 3. A chain of custody form created from the AIMS II database (Attachment 7) and a sample analysis request form (Attachment 8) accompanies each sample set through the analytical process.

Table 3. *E.coli*, Nutrient and General Chemistry Parameters Test Methods

Parameter	Method	Limits of Quantification	Units	Preservative	Holding Times
<i>E. coli</i>	SM-9223 B Enzyme Substrate Test	1.0	*MPN /100 mL	0.0008% Na ₂ S ₂ O ₃	8 hours
Alkalinity (as CaCO ₃)	EPA 310.2	10.0	mg/L	None	14 days
Total Solids	SM 2540B	10.0	mg/L	None	7 days

Parameter	Method	Limits of Quantification	Units	Preservative	Holding Times
Total Suspended Solids	SM 2540D	4.0	mg/L	None	7 days
Total Dissolved Solids	SM 2540C	10.0	mg/L	None	7 days
Sulfate	EPA 375.2	0.3	mg/L	None	28 days
Chloride	SM4500CL-E	5.0	mg/L	None	28 days
Hardness (as CaCO ₃)	EPA 130.1	30	mg/L	HNO ₃ < pH 2	6 months
Ammonia Nitrogen	EPA 350.1	0.10	mg/L	H ₂ SO ₄ < pH 2	28 days
TKN	EPA 351.2	0.30	mg/L	H ₂ SO ₄ < pH 2	28 days
Nitrate/Nitrite	EPA 353.1	0.10	mg/L	H ₂ SO ₄ < pH 2	28 days
Total Phosphorus	EPA 365.1	0.03	mg/L	H ₂ SO ₄ < pH 2	28 days
TOC	SM 5310B	1.0	mg/L	H ₂ SO ₄ < pH 2	28 days
COD	SM5220D	10.0	mg/L	H ₂ SO ₄ < pH 2	28 days

* Clesceri et al., 1998. 1 MPN = 1 CFU/100 mL

Field Parameters Measurements:

The field measurements of DO, temperature, pH, conductivity, and turbidity are taken each time a sample is collected. The field parameters and their respective test methods and sensitivity limits are identified below in Table 4.

During each sampling run, field observations from each site and ambient weather conditions at the time of sampling are noted and documented on stream sampling field data sheets (Attachment 3). A digital photo both up-stream and down-stream of the sampling site will be taken, logged, and documented for later references.

Table 4. Field Parameters Test Methods

Parameter	Method	Sensitivity Limit	Units
Dissolved Oxygen (Datasonde optical)	ASTM D888-09(C)	0.01	mg/L
Dissolved Oxygen (Datasonde)	SM 4500-OG	0.03	mg/L
Dissolved Oxygen (Winkler Titration)	SM 4500-OC ¹	0.2	mg/L
Dissolved Oxygen % Saturation (Datasonde optical)	ASTM D888-09(C)	0.01	%
Dissolved Oxygen % Saturation (Datasonde)	SM 4500-OG	0.01	%
Turbidity (Datasonde)	SM 2130B	0.02	NTU
Turbidity (Hach Turbidimeter)	EPA 180.1 ¹	0.05	NTU
Specific Conductance (Datasonde)	SM 2510B	1.0	µS/cm
Temperature (Datasonde)	SM 2550B(2)	0.1	° Celsius
Temperature (field meter)	SM 2550B(2) ¹	0.1	° Celsius
pH (Datasonde)	EPA 150.2	0.01	SU
pH (field meter)	SM 4500-HB ¹	0.01	SU

¹ Method used for Field Calibration Verification

Quality Control and Custody Requirements: (QAPP Element B5)

Quality assurance protocols will follow part B5 of the “Quality Assurance Project Plan for the Indiana Surface Water Quality Monitoring and Total Maximum Daily Load (TMDL) Program,” Revision 3, by Timothy Bowren and Dr. Syed Ghiasuddin (IDEM 2004).

Field Instrument Testing and Calibrations: (QAPP Elements B6, B7)

The Datasonde will be calibrated immediately prior to each week’s sampling (IDEM 2002). Calibration results and drift values will be recorded, maintained, stored and archived in log books located in the calibration laboratories at the Shadeland facility. The drift value is the difference between two successive calibrations. Field parameter calibrations will conform to the procedures as described in the instrument users’ manuals (Hydrolab Corporation 2002; YSI 2002). The DO component of the calibration procedure will be conducted using the air calibration method. The unit will be field checked for accuracy once during the week by comparison with a Winkler DO test, as well as Hach™ turbidity, pH and temperature meters. Weekly calibration verification results will be recorded on the stream sampling field data sheets (Attachment 3) and entered into the AIMS II database. A Winkler DO test will also be conducted at sites where the DO concentration is 4.0 mg/L or less.

Field Analysis Data

In-situ water chemistry field data are collected in the field using calibrated or standardized equipment. Calculations may be done in the field or later at the office. Analytical results, which have limited QC checks, are included in this category. Detection limits and ranges have been set for each analysis. Quality control checks (such as duplicate measurements, measurements of a secondary standard, or measurements using a different test method or instrument) which are performed on field or laboratory data are usable for estimating precision, accuracy, and completeness for the project.

Bacteriological Sampling

Bacteriological samples will be analyzed using the SM 9223 Enzyme Substrate Coliform Test Method, see Table 3 for quantification limits. Samples will be collected using 120 mL pre-sterilized wide mouth containers and adhere to the six-hour holding time. Analytical results from the IDEM *E. coli* Mobile Laboratory (IDEM, 2002b) include QC check sample results from which precision, accuracy, and completeness can be determined for each batch of samples. Raw data are archived by analytical batch for easy retrieval and review. Chain of custody procedures must be followed, including:

time of collection, time of setup, time of reading the results, and time and method of disposal. Any method deviations will be thoroughly documented in the raw data. All QA/QC samples will be tested according to the following guidelines:

Field Duplicate:

Field Duplicates will be collected at a frequency of 1 per batch or at least 1 for every 20 samples collected ($\geq 5\%$).

Field Blank:

Field Blanks will be collected at a frequency of 1 per batch or at least 1 for every 20 samples collected ($\geq 5\%$).

Laboratory Blank:

Laboratory Blanks (sterile laboratory water blanks) will be tested at a frequency of 1 per day.

Positive Control:

Each lot of media will be performance tested using positive *E. coli* bacterial cultures.

Negative Controls:

Each lot of media will be performance tested using total non-*E. coli* coliform and noncoliform bacterial cultures.

Water Chemistry Data

Sample bottles and preservatives certified for purity will be used. Sample collection containers for each parameter, preservative, and holding times will meet U.S. EPA requirements (Clesceri et al., 1998). Field duplicates and matrix spike/matrix spike duplicates (MS/MSD) shall be collected at the rate of one per sample analysis set or one per every 20 samples, whichever is greater. Additionally, field blank samples will be taken at a rate of one set per sample analysis set or one per every 20 samples, whichever is greater.

Fish Community Data

Replicate fish community sampling will be performed at a rate of 10 percent of the total fish community sites sampled, or approximately 4 in the basin (U.S. EPA 1995).

Replicate sampling will be performed once all initial sites have been sampled, with at least 2 weeks of recovery between the initial and replicate sampling events. The fish community replicate sampling and habitat assessment will be performed with either a partial or complete change in field team members (U.S. EPA 1994; U.S. EPA 1995). The resulting IBI and QHEI total score between the initial visit and the revisit will be used to evaluate precision. A chain of custody form is used to track samples from the

field to the laboratory. Fish in the laboratory may be verified by regionally recognized non-IDEM freshwater fish taxonomists. All data are checked for:

- 1) Completeness;
- 2) Completed calculations
- 3) That data has been entered into the AIMS database; and, 4) A final check for data entry errors.

Macroinvertebrate Community Data

Replicate macroinvertebrate field samples will be collected at every 10th site. This will result in a precision evaluation based on a 10% replicate of samples collected. Laboratory identifications and QA/QC of taxonomic work is maintained by the laboratory supervisor of the Probabilistic Monitoring Section of the WAPB.

III. ASSESSMENT/OVERSIGHT: (QAPP Elements C1, C2)

Field and laboratory performance and system audits will be performed to ensure good quality data. The field and laboratory performance includes precision measurements by relative percent difference of field and laboratory duplicate, accuracy measurements by percent of recovery of MS/MSD samples analyzed in the laboratory, and completeness measurements by the percent of planned samples that are actually collected, analyzed, reported, and usable for the project. For more detail, see section A7.2 in the QAPP for the Indiana Surface Water Quality Monitoring Program, Revision 3 (IDEM 2004).

Data Quality Assessment Levels

The samples and various types of data collected by this program are intended to meet different DQA Levels as cited in the QAPP for Indiana Surface Water Quality Monitoring Program, Revision 3 (IDEM 2004). The level of QA and the DQA Level to which the analytical data qualifies will be as follows:

DQA Level 1 Screening Data: The results are usually generated onsite and have no QC checks. Analytical results, which are just numbers, and have no QC checks, no precision or accuracy information, and no detection limit calculations are included in this category. Primarily, onsite data are used for pre-surveys and for preliminary rapid assessment.

DQA Level 2 Field Analysis Data: Data are recorded in the field or laboratory on calibrated or standardized equipment. Field duplicates are measured on a regular periodic basis. Calculations may be done in the field or later at the office. Analytical results, which have limited QC checks, are included in this category. Detection limits and ranges have been

set for each analysis. The QC checks information for field or laboratory results is useable for estimating precision, accuracy, and completeness for the project. Data from this category are used independently for rapid assessment and preliminary decisions.

DQA Level 3 Laboratory Analytical Data: Analytical results include QC check samples for each batch of samples from which precision, accuracy, and completeness can be determined. Method detection limits (MDLs) have been determined using 40 Code of Federal Regulations (CFR) Part 136 Appendix B (CFR 2012). Additionally, all reporting information required in the laboratory contract, and in the IDEM Surface Water Quality Monitoring and TMDL QAPP, especially Table A9-1, is included in the analytical data reports. Raw data, chromatograms, spectrograms, and bench sheets are not included as part of the analytical report, but are maintained by the contract laboratory for easy retrieval and review. Data can be elevated from DQA Level 3 to DQA Level 4 by inclusion of this information in the data report and the QC data are reported using contract laboratory program (CLP) forms or CLP format. Data in this category are considered as complete, legally defensible, and used for regulatory decisions.

DQA Level 4 Enforcement Data: *Analytical results mostly meet the U.S. EPA required CLP data analysis, Contract Required Quantification Limits (CRQL), and validation procedures.* QC data are reported on CLP forms or CLP format. Raw data, chromatograms, spectrograms, and bench sheets are included as part of the analytical report. Additionally, all reporting information required in the laboratory contract, and in the *IDEM Surface Water Quality Monitoring Program and TMDL QAPP*, are included in the analytical data reports. Data falling under this category are considered as complete, legally quantitative in value, and used for regulatory decisions.

All samples collected for bacteriological and laboratory analysis for this project will adhere to DQA Level 3. All field parameters collected for this project will adhere to DQA Level 2. All of the sample data are QA/QC'd for completeness, precision, and accuracy.

IV. DATA VALIDATION AND USABILITY: (QAPP Element D1, D2)

Quality Assurance/Data Qualifiers and Flags:

The various data qualifiers and flags used for QA and validation of the data are outlined below in Table 5.

Table 5. Data Qualifiers and Flags

Flags	Description
R	Rejected. Result is not acceptable for use in decision making processes.
J	Estimated. The use of the result in decision making processes will be determined on a case by case basis .
U	Between MDL and RL -- The result of the parameter is above the Method Detection Limit (MDL) but below the Lab Reporting Limit (RL) and will be estimated.
Q	QC Checks or Criteria -- One or more of the QC checks or criteria is out of control
D	<p>RPD for Duplicates -- The Relative Percent Difference (RPD) for a parameter is outside the acceptable control limits. The parameter will be considered estimated or rejected on the basis listed below:</p> <ol style="list-style-type: none"> 1. If the Sample or Duplicate value is <u>less than the RL</u>, and the other value <u>exceeds 5 times the MDL</u>, then the sample will be estimated. 2. If the RPD is outside the established control limits (max. RPD) but below two times the established control limits (max. RPD), then the sample will be estimated. 3. If the RPD is twice the established control limits (max. RPD) or greater, then the sample will be rejected.

Flags	Description
B	<p>Blank Contamination -- This parameter is found in a field or a lab blank. Whether the result is accepted, estimated, or rejected will be based upon the level of contamination listed below:</p> <ol style="list-style-type: none"> 1. If the result of the sample is greater than the reporting limit but less than five times the blank contamination, the result will be rejected. 2. If the result of the sample is between five and ten times the blank contamination, the result will be estimated. 3. If the result of the sample is less than the reporting limit or greater than ten times the blank contamination, the result will be accepted.
H	<p>Holding Time -- The analysis for this parameter was performed out of the holding time. The results will be estimated or rejected on the basis listed below:</p> <ol style="list-style-type: none"> 1. If the analysis was performed between the holding time limit and 1.5 times the holding time limit, the result will be estimated. 2. If the analysis was performed outside the 1.5 times the holding time limit, the result will be rejected.

Data Usability:

The environmental data collected and its usability are finally qualified and classified into one or more of the four categories: Acceptable Data, Enforcement Capable Results, Estimated Data and Rejected Data.

- **Acceptable Data** are suitable for decision making and have no flagged data points.
- **Enforcement Capable Results** meets all QC checks and have no flagged data points.
- **Estimated Data** may be suitable for enforcement or decision making on a case by case basis.
- **Rejected Data** are not suitable for enforcement or for decision making.

Laboratory and Estimated Cost:

Laboratory analysis and data reporting for this project will comply with the QAPP for Indiana Surface Water Quality Monitoring and TMDL Program (IDEM/100/29/338/073/2004, see IDEM 2004), Request for Proposals (RFP) 12-48, and

the Office of Water Quality Assessment Branch Quality Management Plan (B-001-OWQ-A-00-08-R00, see IDEM 2008a). Analytical tests on the general chemistry and nutrient parameters outlined in Table 3 will be performed by the ISDH Environmental Lab in Indianapolis, Indiana at no direct cost. Supplies for the bacteriological sampling will come from IDEXX Laboratories, Inc., Westbrook, Maine with a total estimated cost for this project of \$1,530. All fish and macroinvertebrate samples will be collected and analyzed by IDEM staff.

Reference Manuals and Personnel Safety:

All staff persons who participate in the field component of this study are required to have completed Basic First Aid and Cardio-Pulmonary Resuscitation (CPR) training. According to the memorandum “Change in status of Water Assessment Branch staff in accordance with the Agency training policy” dated November 29, 2010, OWQ Watershed Assessment and Planning Branch staff is exempt from initial and annual training requirements set forth in Section 6.0 of the IDEM Health and Safety Training Policy (IDEM 2010b). The memorandum also states “as an alternative to the training requirements of the policy, the Branch will conduct in-service training at a minimum of four (4) hours per year on topics directly related to duties performed by staff.” New hires or those changing job responsibilities without the minimum four- hour training must be accompanied in the field by a staff member who has met the requirements of the branch health and safety training.

Field personnel collecting water chemistry and bacteriological samples will follow policies and procedures established in the Surveys Section Field Procedures Manual (IDEM 2002) and the Hazardous Communication Plan Supplement (IDEM 1997). Field personnel collecting fish and macroinvertebrate community samples must read and comply with the Biological Studies Section SOP Manual: Section II. Hazard Communication’s Manual (IDEM 1992e) which includes four, yellow, 3-ring binders consisting of 1) Safety Manual 2) Hazard Communication and SOP 3) Occupational Safety and Health Administration Handbooks 4) Material Safety Data Sheets as well as “Field and Laboratory Operating Procedures for use, handling and storage of chemicals in the laboratory” (Newhouse 1998a) and “Field and Laboratory Operating Procedures for Use, Handling, and Storage of Solutions Containing Formaldehyde” (Newhouse 1998b).

Sampling on surface waters requires safety consciousness of staff members and the use of specialized equipment; thus, staff will comply with the IDEM Personal Protective Equipment (PPE) Policy (IDEM 2008b). If an injury or illness arises in the field, staff will follow the IDEM Injury and Illness Resulting from Occupational Exposure Policy (IDEM 2010c). Operating in and around waterbodies carries the inherent risk of drowning; thus, personnel involved in sample collection will wear appropriate clothing and PPE when operating boats or sampling in deep water or swift currents. According to the memorandum “Use of Personal Flotation Devices (PFDs) by Branch Personnel” dated

February 29, 2000, staff must wear U.S. Coast Guard approved Type I, II, or III PFDs whenever:

- the planned work requires them to enter the water and the maximum water depth at any place at the work site is over their knee (note that this depth depends on the employee, but it will usually be between 12 and 20 inches or 300-500 mm); or,
- the employee is in a watercraft of any kind that is being launched, is in the water, or is being retrieved from the water; or,
- the employee must work from structures that do not possess guard rails and are over or alongside water which is, or could reasonably be expected to be, 3 feet deep.

In addition, when work is being done in boats on co-jurisdictional waters (as defined by Indiana Code (IC) 14-8-2-315) or during hours of darkness on any waters of the state, all personnel in the watercraft must wear a high intensity whistle and Safety of Life at Sea (SOLAS) certified strobe light.

Safety issues are the responsibility of all crew members; however, any questions in the field should be directed to the field crew leader. The field crew leader is responsible for the completion of all work listed in the workplan, the health and safety aspects of the sampling event, and successful interactions with landowners and members of the public.

REFERENCES:

- Barbour, M.T., J. Gerritsen, B.D. Snyder and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA/841/B-99/002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C. Report available at <http://water.epa.gov/scitech/monitoring/rsl/bioassessment/>
- Clesceri, L.S., Greenburg, A.E., Eaton, A.D., 1998. SM-Standards Methods for the Examination of Water and Wastewater 20th Edition. American Public Health Association.
- Code of Federal Regulations (CFR). 40 CFR Part 136, Appendix B, Revised March 12, 2007. Available at <http://www.gpo.gov/fdsys/pkg/CFR-2012-title40-vol24/pdf/CFR-2012-title40-vol24-part136-appB.pdf>
- Hydrolab Corporation. 2002, revision c. Quanta Water Quality Monitoring System Operating Manual. Loveland, Colorado. Available at http://www.hachhydromet.com/web/ott_hach.nsf/id/pa_users_manuals_e.html
- IAC(Indiana Administrative Code), Title 327 Water Pollution Control Division, Article 2. Water Quality Standards. Last updated February 12, 2014. Available at http://www.in.gov/legislative/iac/iac_title?iact=327
- IDEM. 1992a, revision 1. Section 3, Quality Assurance Project Plan, Development of Biological Criteria (Fish) for the Ecoregions of Indiana. Biological Studies Section, Surveillance and Standards Branch, Office of Water Management, Indiana Department of Environmental Management, Indianapolis, Indiana.
- IDEM. 1992b, revision 1. Section 4, Standard Operating Procedures for Fish Collections, Use of Seines, Electrofishers, and Sample Processing. Biological Studies Section, Surveillance and Standards Branch, Office of Water Management, Indiana Department of Environmental Management, Indianapolis, Indiana.
- IDEM. 1992c, revision 1. Section 5, Standard Operating Procedures for Conducting Rapid Assessment of Ambient Water Quality Using Fish (RBP-V). Biological Studies Section, Surveillance and Standards Branch, Office of Water Management, Indiana Department of Environmental Management, Indianapolis, Indiana.
- IDEM. 1992d, revision 1. Section 11, Standard Operating Procedures-Appendices of Operational Equipment Manuals and Procedures. Biological Studies Section, Surveillance and Standards Branch, Office of Water Management, Indiana Department of Environmental Management, Indianapolis, Indiana.
- IDEM. 1992e, revision 1. Section 2, Biological Studies Section Hazards Communications Manual (List of Contents). Biological Studies Section, Surveillance

and Standards Branch, Office of Water Management, Indiana Department of Environmental Management, Indianapolis, Indiana.

- IDEM. 1997. Water Quality Surveys Section Laboratory and Field Hazard Communication Plan Supplement. IDEM 032/02/018/1998, Revised October 1998. Assessment Branch, Indiana Department of Environmental Management, Indianapolis, Indiana
- IDEM. 2002. Water Quality Surveys Section Field Procedure Manual, Assessment Branch, Indiana Department of Environmental Management, Indianapolis, Indiana. IDEM, April 2002.
- IDEM. 2002b. Statewide E coli Monitoring Project, July 1999- June 2001, Final Report, Federal 319 Grant Number:C9995008-99-1, State Account Number 3610/552100/140500. IDEM 032/02/051/2002. Report available at: http://www.in.gov/idem/files/wqsurvey_ecolifinalgrantrept.pdf
- IDEM. 2004. Quality Assurance Project Plan (QAPP) for Indiana Surface Water Quality Monitoring and Total Maximum Daily Load (TMDL) Program, (Rev. 3, Oct. 2004).
- IDEM. 2008a. Office of Water Quality Assessment Branch Quality Management Plan, Revision 0. B-001-OWQ-A-00-08-R00. Assessment Branch, Office of Water Quality, Indiana Department of Environmental Management, Indianapolis, Indiana.
- IDEM. 2008b. IDEM Personal Protective Equipment Policy, revised May 1 2008. A-059-OEA-08-P-R0. Office of External Affairs, Indiana Department of Environmental Management, Indianapolis, Indiana.
- IDEM. 2010a. Multi-habitat (MHAB) Macroinvertebrate Collection Technical Standard Operating Procedure. S-001-OWQ-W-BS-10-T-R0. Watershed Planning and Assessment Branch, Office of Water Quality, Indiana Department of Environmental Management, Indianapolis, Indiana.
- IDEM. 2010b. IDEM Health and Safety Training Policy, revised October 1 2010. A-030-OEA-10-P-R2. Office of External Affairs, Indiana Department of Environmental Management, Indianapolis, Indiana.
- IDEM. 2010c. IDEM Injury and Illness Resulting from Occupational Exposure Policy, revised October 1 2010. A-034-OEA-10-P-R2. Office of External Affairs, Indiana Department of Environmental Management, Indianapolis, Indiana
- IDEM. 2012a. Draft 2012 303(d) List Submitted to U.S. EPA on April 1, 2012. Edited by Jody Arthur. Office of Water Quality, Indiana Department of Environmental Management, Indianapolis, Indiana. Available at http://www.in.gov/idem/nps/files/305b_ir_report_2012_apndx_h_attch_5.pdf
- IDEM. 2012b. Indiana's 2012 Consolidated Assessment and Listing Methodology (CALM) - Revised. Edited by Jody Arthur. Office of Water Quality, Indiana

Department of Environmental Management, Indianapolis, Indiana. Available at
http://www.in.gov/idem/nps/files/303d_2012_list_revised_apndx_i_attch_1.pdf

Klemm, D.J., P.A. Lewis, F.Fulk and J.M. Lazorchak. 1990. Macroinvertebrate Field and Laboratory Methods for Evaluating the Biological Integrity of Surface Waters. EPA/600/4-90/030. Environmental Monitoring Systems Laboratory, Monitoring Systems and Quality Assurance, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio.

Newhouse, S.A. 1998a. Field and laboratory operating procedures for use, handling and storage of chemicals in the laboratory. IDEM/32/03/007/1998. Biological Studies Section, Assessment Branch, Office of Water Management, Indiana Department of Environmental Management, Indianapolis, Indiana.

Newhouse, S.A. 1998b. Field and laboratory operating procedures for use, handling and storage of solutions containing formaldehyde. IDEM/32/03/006/1998. Biological Studies Section, Assessment Branch, Office of Water Management, Indiana Department of Environmental Management, Indianapolis, Indiana.

Ohio Environmental Protection Agency (OHEPA). 2006. Methods for Assessing Habitat in Flowing Waters: Using the Qualitative Habitat Evaluation Index (QHEI). OHIO EPA Technical Bulletin EAS/2006-06-1. Revised by the Midwest Biodiversity Institute for State of Ohio Environmental Protection Agency, Division of Surface Water, Ecological Assessment Section, Groveport, Ohio. Report available at
<http://www.epa.state.oh.us/portals/35/documents/qheimanualjune2006.pdf>

Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross and R.M. Hughes. 1989. Rapid Bioassessment Protocols for Use in Streams and Rivers: Benthic Macroinvertebrates and Fish. EPA/440/4-89/001. Assessment and Watershed Protection Division, U.S. Environmental Protection Agency, Washington, D.C. Report available at
<http://nepis.epa.gov/Exe/ZyNET.exe/9100LGCA.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1986+Thru+1990&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C86thru90%5CTxt%5C00000022%5C9100LGCA.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p%7Cf&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyURL>

Rankin, E.T. 1995. Habitat Indices in Water Resource Quality Assessments. pp. 181-208, Chapter 13, Biological Assessment and Criteria: Tools for the Risk-based Planning and Decision Making, edited by Wayne S. Davis and Thomas P. Simon, Lewis Publishers, Boca Raton, Florida.

- Simon, T.P. 1990. Quality Assurance Program Plan: Development of Biological Criteria for the Ecoregions of Indiana. Region V, Environmental Sciences Division, Central Regional Laboratory, Organic Chemistry Section: Biology Team, U.S. Environmental Protection Agency, Chicago, Illinois.
- Simon, T.P. 1997. Biological Characterization of the Middle Fork Anderson River, Perry County, Indiana. EPA 905/R-96/007. Water Division, Watershed and Non-Point Branch, U.S. Environmental Protection Agency, Region V, Chicago. Illinois.
- Simon, T.P. and R.L. Dufour. 1998. Development of Index of Biotic Integrity Expectations for the Ecoregions of Indiana V: Eastern Cornbelt Plain. EPA 905/R-96/004. Water Division, Watershed and Non-Point Branch, U.S. Environmental Protection Agency Region V, Chicago, Illinois. Report available at <http://nepis.epa.gov/Exe/ZyNET.exe/2000BST2.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1995+Thru+1999&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C95thru99%5CTxt%5C00000006%5C2000BST2.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p%7Cf&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyURL>
- Simon, T.P. and R.L. Dufour. 2005. Guide to appropriate metric selection for calculating the Index of Biotic Integrity (IBI) for Indiana Large and Great Rivers, Inland Lakes, and Great Lakes nearshore. U.S. Department of the Interior, Fish and Wildlife Service, Bloomington Field Office, Bloomington, Indiana.
- SonTek/YSI Inc 2001, SonTek/YSI ADP[®] Acoustic Doppler Profiler Technical Documentation. 2001. Available at <http://www.sontek.com/adp-adcp.php>
- SonTek/YSI Inc 2007, FlowTrackers[®] User's Manual. 2007. Available at <http://www.sontek.com/flowtracker.php>
- United States Environmental Protection Agency (U.S. EPA). March 1994. Environmental Monitoring and Assessment Program, Surface Waters and Region 3 Regional Environmental Monitoring and Assessment Program, 1994 Pilot Field Operations and Methods Manuals for Streams. EPA/620/R-94/004F. Edited by Donald J. Klemm and James M. Lazorchak. Bioassessment and Ecotoxicology Branch, Ecological Monitoring Research Division, Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio. Report available at http://www.epa.gov/emap2/html/pubs/docs/groupdocs/surfwatr/field/ws_abs.html
- U.S. EPA 1995, Region 5 R-EMAP Full Proposal: Spatial Evaluation of the Eastern Corn Belt Plain Rivers and Streams for the Development of Reference Condition

using EMAP Sampling Design and Indicators, with Comparison of Results to Nonrandom Intensive.

U.S. EPA, 2000. Guidance for the Data Quality Objectives Process. EPA QA/G-4. EPA/600/R-96/055, August 2000. Report available at <http://www.epa.gov/region6/qa/qadevtools/mod4references/secondaryguidance/g4-final.pdf>

YSI Incorporated. 2002, revision b. 6-Series Environmental Monitoring Systems Manual, Yellow Springs, Ohio. Available at <http://www.ysi.com/mwq-internal/de5fs23hu73ds/progress?id=fdaTJVUSbg>

DISTRIBUTION LIST:

Electronic Distribution Only: (QAPP Element A3)

<u>Name</u>	<u>Organization</u>
Kris Kehoe	IDEM/OWQ/ Watershed Assessment and Planning Branch / Targeted Monitoring Section
Cyndi Wagner	IDEM/OWQ/ Watershed Assessment and Planning Branch / Targeted Monitoring Section
Chuck Bell	IDEM/OWQ/ Watershed Assessment and Planning Branch /Technical and Logistics Section
Stacey Sobat	IDEM/OWQ/ Watershed Assessment and Planning Branch /Probabilistic Monitoring Section
Timothy Bowren	IDEM/OWQ/ Watershed Assessment and Planning Branch /Technical and Logistics Section
Ali Meils	IDEM/OWQ/ Watershed Assessment and Planning Branch /Watershed Planning and Restoration Section
Cory Fischer	IDEM/OWQ/ Watershed Assessment and Planning Branch /Watershed Planning and Restoration Section
Bonny Elifritz	IDEM/OWQ/ Watershed Assessment and Planning Branch /Watershed Planning and Restoration Section
Kathleen Hagan	IDEM/OWQ/ Watershed Assessment and Planning Branch /Watershed Planning and Restoration Section
Staci Goodwin	IDEM/OWQ/ Watershed Assessment and Planning Branch /Watershed Planning and Restoration Section
Marylou Renshaw	IDEM/OWQ/ Watershed Assessment and Planning Branch
Jody Arthur	IDEM/OWQ/ Watershed Assessment and Planning Branch /Technical E7
David Parry	IDEM/ Office of Compliance Support/Planning and Assessment/ Quality Improvement Section
Michael Spinar	IDEM/Office of Compliance Support/Planning and Assessment/ Quality Improvement Section

Attachment 1: Modified Geometric Design Steps for Baseline Studies

Introduction

A relatively new design that has been implemented recently in Indiana is termed the Modified Geometric Site Selection process. This design is employed within watersheds that correspond to the 10 digit HUC scale (6th to 7th level watersheds) in order to fulfill multiple water quality management objectives in addition to the conventional focus on status assessment. It is employed at a spatial scale that is representative of the scale at which watershed management is generally being conducted. Sites within the watershed are allocated based on a geometric progression of drainage areas starting with the area at the mouth of the main stem river or stream (pour point) and working “upwards” through the various tributaries to the primary headwaters. This approach allocates sampling sites in a semi-random fashion and according to the stratification of available stream and river sizes based on drainage area. It is then supplemented by a targeted selection of additional sampling sites that are used to focus on localized management issues such as point source discharges, habitat modifications, and other potential impacts within a watershed. These sites are then “snapped to bridges” to facilitate safe and easy access to the stream. This design also fosters data analysis that takes into consideration overlying natural and human caused influences within the streams of a watershed. The design has been particularly useful for watersheds that are targeted for TMDL development in that unassessed waters and incomplete or outdated assessments can be addressed prior to TMDL development.

Selection Process

In ArcGIS, download from NHD Plus site (<http://www.horizon-systems.com/nhdplus/HSC-wthMS.php>) the following files for Region 5 (and then again for Region 7) and zip into appropriate file structure

File Description	File Name (.zip***)	Format
Region 05, Version 01_01, Catchment Grid	NHDPlus05V01_01_Catgrid	ESRI Grid
Region 05, Version 01_01, Catchment Shapefile	NHDPlus05V01_01_Catshape	Shapefile
Region 05, Version 01_02, Catchment Flowline Attributes	NHDPlus05V01_02_Cat_Flowline_Attr	DBF
Region 05, Version 01_02, Elevation Unit a	NHDPlus05V01_02_Elev_Unit_a	ESRI Grid
Region 05, Version 01_02, Elevation Unit b	NHDPlus05V01_02_Elev_Unit_b	ESRI Grid
Region 05, Version 01_02, Elevation Unit c	NHDPlus05V01_02_Elev_Unit_c	ESRI Grid
Region 05, Version 01_01, Flow Accumulation and Flow Direction Unit a	NHDPlus05V01_01_FAC_FDR_Unit_a	ESRI Grid
Region 05, Version 01_01, Flow Accumulation and Flow Direction Unit b	NHDPlus05V01_01_FAC_FDR_Unit_b	ESRI Grid
Region 05, Version 01_01, Flow Accumulation and Flow Direction Unit c	NHDPlus05V01_01_FAC_FDR_Unit_c	ESRI Grid
Region 05, Version 01_02, National Hydrography Dataset	NHDPlus05V01_03_NHD	Shapefile and DBF
Region 05, Version 01_01, Stream Gage Events	NHDPlus05V01_01_StreamGageEvent	Shapefile
Region 05, Version 01_01, QAQC Sinks Spreadsheet	NHDPlus05V01_01_QAQC_Sinks	Excel Spreadsheet

Create new point shapefile (or geodatabase featureclass) named Geometric Design within ArcCatalog with the same projection as the unzipped layers above

Within an ArcMap project add the; nhdfowline layer, Geometric Design layer, catchment shapefile, and the FlowlineAttributesFlow table.

Add the following fields to the nhdfowline layer:

LENGTHMi (type: double, precision: 9, scale 4)

DrainMi (type: double, precision: 9, scale 4)

MinElev (type: double, precision: 9, scale 4)

MaxElev (type: double, precision: 9, scale 4)

Gradient (type: double, precision: 9, scale 4)

Add the following field to the GeometricDesign layer (use add field-batch tool):

Geometric (type: double, precision: 5, scale 2)

Lat (type: double, precision: 8, scale 5)

Long (type: double, precision: 8, scale 5)

COMID (type: long, precision: 9)

Join the nhdfLOWline layer with the FlowlineAttributesFlow table based on the COMID field

Use the field calculator within the nhdfLOWline attribute table, with the appropriate metric to imperial conversion to populate LENGTHMi (from LENGTHKM – kilometers to miles), DrainMia (from CumDrainage – square kilometers to square miles), MinElev (from MinElevSmo – meters to feet), MaxElev (from MaxElevSmo – meters to feet), and Gradient ((MaxElev-MinElev)/LENGTHMi).

Unjoin FlowlineAttributesFlow table.

Label “nhdfLOWline” layer based new “LengthMi” field – note: this field shows the cumulative drainage at the *end* of the line segment, which rarely is more than 2-3 miles in between nodes.

Calculate the geometric break points (i.e. for a 500 sq mi watershed; 500, 250, 125, 62.5, 31, 15, 7, 4, and 2 sq mi).

It is recommended to change the symbology (Symbology: Show Quantities: Classification (Manual)) of the actual flowline to reflect the drainage. This will help identify when and where sites need to be allocated.

Start a new editing session, with the GeometricDesign layer as your target layer.

Add a new point within this layer to the pour point for the watershed (500 sq mi in this case)

Travel upstream through the mainstem and “find” the next place on the stream where the river drainage brackets 250sq mi. Use the catchment shapefile layer to identify more precisely the drainage value if needed.

Populate the “Geometric” field within the GeometricDesign layer accordingly to the identified drainage level, then change the symbology (Symbology: Categories: Unique Values: Geometric field) of this layer to reflect the drainage levels.

Proceed through the watershed (either around the outer portions or start with largest values and work in), adding points accordingly to each geometric level. Change the symbology to find areas or levels that were missed. Note – the drainage level must be exact. Use catchment shapefile to subtract drainage areas from larger drainage areas until the exact drainage level is reached. It is ok to “skip” a geometric level if it is not exactly reached. Sometimes there are large tributaries whose contribution to the mainstem skips a drainage level.

Populate the COMID (manually), and Lat/Long (right click on field and select calculate geometry – lat = x-coordinates and long = y-coordinates) accordingly for reference within the GeometricDesign Layer

Once sites are selected in this fashion they will need to be snapped to a bridge or access point.

Additional sites should be placed at pour points of subwatersheds (12-digit HUCs) to meet TMDL document requirements.

Once the initial sites are selected the following features are taken into account to move or add sites:

- Permitted facilities
- Urban areas
- Historical sampling sites
- Assessment Unit IDs (AUID)
- External stakeholder information
- Resources - maximum of 35 sites per project

After refining site selections there may be additional sites added to ensure spatial representation of project area.

Sites may be removed or changed after site reconnaissance if there are problems accessing the site or if sites are dry.

Notes regarding the NHD dataset:

All units are initially set to metric and need to be converted to imperial accordingly

Within the nhdfowline layer, the GNIS_Name/ID refers to the whole river name and ID, while the COMID is a unique identifier for the particular segment

There is *not* a value GNIS_Name/ID for every river, especially where primary streams and ditches are concerned.

Segments within the nhdfowline layer are based on linear miles between “nodes” which are broken up (typically) by tributary. Typically these lengths are < 2-3 miles.

The cumulative drainage values in the NHD dataset have been compared against other and deemed “reasonable” (read – not statistically compared). Also note that the drainage is calculated through the model to be at the pour point of that segment

However, the elevation values are **not** reliable and require supervision. These values are calculated from the associated DEM and sometimes have null values for either max or min. In addition the length of stream is not long enough (i.e. >1 mile) to calculate gradient. In either case this associated value is helpful to identify contour changes against a USGS contour map. However, to note the calculated gradient from the NHD information has been observed to be within several tenths of mile compared to a manual calculation of gradient.

Important tables from NHD

FlowlineAttributesFlow (found in: Region 05, Version 01_02, Catchment Flowline Attributes)

Key fields: CumDrainag, Max ElevRaw, MinElevSmo,

Important Layers from NHD

Region 05, Version 01_01, Catchment Shapefile

Region 05, Version 01_02, National Hydrography Dataset

Attachment 2: Blank Stream Sampling Field Data Sheet

IDEM Stream Sampling Field Data Sheet										Analysis Set #	EPA Site ID	Rank
Sample #	Site #	Sample Medium				Sample Type		Duplicate Sample #				
Stream Name:					River Mile:		County:					
Site Description:												
Survey Crew Chief	Sample Collectors			Sample Collected		Hydrolab #	Water Depth/Gage Ht (ft)	Water Flow (cfs/sec)	Flow Estimated?	Algae?	Aquatic Life?	
	1	2	3	4	Date	Time			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample Taken?		Aliquots		Water Flow Type		Water Appearance		Canopy Closed %				
<input type="checkbox"/> Yes <input type="checkbox"/> No; Frozen <input type="checkbox"/> No; Stream Dry <input type="checkbox"/> No; Other <input type="checkbox"/> No; Owner refused Access		<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 8 <input type="checkbox"/> 8 <input type="checkbox"/> 12 <input type="checkbox"/> 24 <input type="checkbox"/> 48 <input type="checkbox"/> 72 <input type="checkbox"/> All-Flow		<input type="checkbox"/> Riffle <input type="checkbox"/> Dry <input type="checkbox"/> Stagnant <input type="checkbox"/> Pool <input type="checkbox"/> Run <input type="checkbox"/> Flood <input type="checkbox"/> Glide <input type="checkbox"/> Eddy <input type="checkbox"/> Other		<input type="checkbox"/> Clear <input type="checkbox"/> Green <input type="checkbox"/> Sheen <input type="checkbox"/> Murky <input type="checkbox"/> Black <input type="checkbox"/> Other <input type="checkbox"/> Brown <input type="checkbox"/> Gray (Septic/Sewage)		<input type="checkbox"/> 0-20% <input type="checkbox"/> 60-80% <input type="checkbox"/> 20-40% <input type="checkbox"/> 80-100% <input type="checkbox"/> 40-60%				
Special Notes:												

Field Data:

Date (m/d/yy)	24-hr Time (hh:mm)	D.O. (mg/l)	pH	Water Temp (°C)	Spec Cond (µohms/cm)	Turbidity (NTU)	% Sat.	Chlorine (mg/l)	Chloride (mg/l)	Chlorophyll (mg/l)	Weather Codes	SC	WD	WS	AT
Comments															
Comments															
Comments															
Comments															
Comments															
Comments															

Measurement Flags	<	< Min. Meter Measurement	>	> Max. Meter Measurement	E	Estimated (See Comments)	R	Rejected (See Comments)	Weather Code Definitions			
									SC	WD	WS	AT
									Sky Conditions	Wind Direction	Wind Strength	Air Temp

Field Calibrations:

Date (m/d/yy)	Time (hh:mm)	Calibrator Initials	Calibrations			
			Type	Meter #	Value	Units

Calibration Type	pH	DO	Turbidity

Preservatives/Bottle Lots:

Group: Preservative	Preservative Lot #	Bottle Type	Bottle Lot #	Group: Preservatives	Bottle Types
				GC General Chemistry: Ice	2000P 2000mL Plastic, Narrow Mouth
				Nx Nutrients: H2SO4	1000P 1000mL Plastic, Narrow Mouth
				Metals: HNO3	500P 500mL Plastic, Narrow Mouth
				CN Cyanide: NaOH	250P 250mL Plastic, Narrow Mouth
				O&G Oil & Grease: H2SO4	1000G 1000mL Glass, Narrow Mouth
				Toxics: Ice	500G 500mL Glass, Wide Mouth
				Ecol Bacteriology: Ice	250G 250mL Glass, Wide Mouth
				VOA Volatile Organics: HCl & Thiosulfate	125G 125mL Glass, Wide Mouth
				Pest Pesticides: Ice	40GV 40mL Glass Vial
				Phen Phenols: H2SO4	120PB 120mL Plastic (Bacteria Only)
				Sed Sediment: Ice	1000PF 1000mL Plastic, Coming Filter
				Gly Glyphosate: Thiosulfate	500PF 500mL Plastic, Coming Filter
				Hg Mercury(1631): HCl	60P 60mL Plastic
				CrS Chromium(VI)(1636): NaOH	250T 250mL Teflon
				MeHg Methyl Mercury(1630): HCl	500T 500mL Teflon
					125T 125mL Teflon

Data Entered By: _____ QC1: _____
 QC2: _____

Stream Sampling Field Data Sheet

Attachment 3: Blank OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index) Form (front)

OWQ Biological QHEI (Qualitative Habitat Evaluation Index)																							
Sample #	bioSample #	Stream Name	Location																				
Surveyor	Sample Date	County	Macro Sample Type	<input type="checkbox"/> Habitat Complete	QHEI Score: 																		
<p>1) SUBSTRATE Check ONLY Two predominant substrate TYPE BOXES; estimate % and check every type present</p> <table style="width:100%;"> <tr> <th style="width:15%;">BEST TYPES</th> <th style="width:15%;">PRESENT TOTAL %</th> <th style="width:15%;">PREDOMINANT</th> <th style="width:15%;">OTHER TYPES</th> <th style="width:15%;">PRESENT TOTAL %</th> <th style="width:15%;">ORIGIN</th> <th style="width:15%;">QUALITY</th> </tr> <tr> <td> <input type="checkbox"/> BLDG/SLABS [10] <input type="checkbox"/> BOULDER [9] <input type="checkbox"/> COBBLE [8] <input type="checkbox"/> GRAVEL [7] <input type="checkbox"/> SAND [6] <input type="checkbox"/> BEDROCK [5] </td> <td> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </td> <td> <input type="checkbox"/> HARDPAN [4] <input type="checkbox"/> DETRITUS [3] <input type="checkbox"/> MUCK [2] <input type="checkbox"/> SILT [2] <input type="checkbox"/> ARTIFICIAL [0] </td> <td> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </td> <td> <input type="checkbox"/> LIMESTONE [1] <input type="checkbox"/> TILLS [1] <input type="checkbox"/> WETLANDS [0] <input type="checkbox"/> HARDPAN [0] <input type="checkbox"/> SANDSTONE [0] <input type="checkbox"/> RIP/RAP [0] <input type="checkbox"/> LACUSTRINE [0] <input type="checkbox"/> SHALE [-1] <input type="checkbox"/> COAL FINES [-2] </td> <td> <input type="checkbox"/> HEAVY [-2] <input type="checkbox"/> MODERATE [-1] <input type="checkbox"/> NORMAL [0] <input type="checkbox"/> FREE [1] </td> <td> <div style="border: 1px solid black; width: 40px; height: 40px; margin: 0 auto;"></div> <p style="text-align: center;">Substrate Maximum 20</p> </td> </tr> </table> <p>NUMBER OF BEST TYPES: <input type="checkbox"/> 4 or more [2] <input type="checkbox"/> 3 or less [0] (sludge from point-sources)</p>										BEST TYPES	PRESENT TOTAL %	PREDOMINANT	OTHER TYPES	PRESENT TOTAL %	ORIGIN	QUALITY	<input type="checkbox"/> BLDG/SLABS [10] <input type="checkbox"/> BOULDER [9] <input type="checkbox"/> COBBLE [8] <input type="checkbox"/> GRAVEL [7] <input type="checkbox"/> SAND [6] <input type="checkbox"/> BEDROCK [5]	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 	<input type="checkbox"/> HARDPAN [4] <input type="checkbox"/> DETRITUS [3] <input type="checkbox"/> MUCK [2] <input type="checkbox"/> SILT [2] <input type="checkbox"/> ARTIFICIAL [0]	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 	<input type="checkbox"/> LIMESTONE [1] <input type="checkbox"/> TILLS [1] <input type="checkbox"/> WETLANDS [0] <input type="checkbox"/> HARDPAN [0] <input type="checkbox"/> SANDSTONE [0] <input type="checkbox"/> RIP/RAP [0] <input type="checkbox"/> LACUSTRINE [0] <input type="checkbox"/> SHALE [-1] <input type="checkbox"/> COAL FINES [-2]	<input type="checkbox"/> HEAVY [-2] <input type="checkbox"/> MODERATE [-1] <input type="checkbox"/> NORMAL [0] <input type="checkbox"/> FREE [1]	<div style="border: 1px solid black; width: 40px; height: 40px; margin: 0 auto;"></div> <p style="text-align: center;">Substrate Maximum 20</p>
BEST TYPES	PRESENT TOTAL %	PREDOMINANT	OTHER TYPES	PRESENT TOTAL %	ORIGIN	QUALITY																	
<input type="checkbox"/> BLDG/SLABS [10] <input type="checkbox"/> BOULDER [9] <input type="checkbox"/> COBBLE [8] <input type="checkbox"/> GRAVEL [7] <input type="checkbox"/> SAND [6] <input type="checkbox"/> BEDROCK [5]	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 	<input type="checkbox"/> HARDPAN [4] <input type="checkbox"/> DETRITUS [3] <input type="checkbox"/> MUCK [2] <input type="checkbox"/> SILT [2] <input type="checkbox"/> ARTIFICIAL [0]	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 	<input type="checkbox"/> LIMESTONE [1] <input type="checkbox"/> TILLS [1] <input type="checkbox"/> WETLANDS [0] <input type="checkbox"/> HARDPAN [0] <input type="checkbox"/> SANDSTONE [0] <input type="checkbox"/> RIP/RAP [0] <input type="checkbox"/> LACUSTRINE [0] <input type="checkbox"/> SHALE [-1] <input type="checkbox"/> COAL FINES [-2]	<input type="checkbox"/> HEAVY [-2] <input type="checkbox"/> MODERATE [-1] <input type="checkbox"/> NORMAL [0] <input type="checkbox"/> FREE [1]	<div style="border: 1px solid black; width: 40px; height: 40px; margin: 0 auto;"></div> <p style="text-align: center;">Substrate Maximum 20</p>																	
<p>Comments</p>																							
<p>2) INSTREAM COVER Indicate presence 0 to 3 and estimate percent: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed root wad in deep/fast water, or deep, well-defined, functional pools.)</p> <table style="width:100%;"> <tr> <th style="width:15%;">% Amount</th> <th style="width:15%;">% Amount</th> <th style="width:15%;">% Amount</th> <th style="width:15%;">% Amount</th> <th style="width:15%;">% Amount</th> <th style="width:15%;">% Amount</th> </tr> <tr> <td> <input type="checkbox"/> UNDERCUT BANKS [1] <input type="checkbox"/> OVERHANGING VEGETATION [1] <input type="checkbox"/> SHALLOWS (IN SLOW WATER) [1] <input type="checkbox"/> ROOTMATS [1] </td> <td> <input type="checkbox"/> POOLS > 70m [2] <input type="checkbox"/> ROOTWADS [1] <input type="checkbox"/> BOULDERS [1] </td> <td> <input type="checkbox"/> OXBOWS, BACKWATERS [1] <input type="checkbox"/> AQUATIC MACROPHYTES [1] <input type="checkbox"/> LOGS OR WOODY DEBRIS [1] </td> <td> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </td> <td> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </td> <td> <div style="border: 1px solid black; width: 40px; height: 40px; margin: 0 auto;"></div> <p style="text-align: center;">Cover Maximum 20</p> </td> </tr> </table>										% Amount	% Amount	% Amount	% Amount	% Amount	% Amount	<input type="checkbox"/> UNDERCUT BANKS [1] <input type="checkbox"/> OVERHANGING VEGETATION [1] <input type="checkbox"/> SHALLOWS (IN SLOW WATER) [1] <input type="checkbox"/> ROOTMATS [1]	<input type="checkbox"/> POOLS > 70m [2] <input type="checkbox"/> ROOTWADS [1] <input type="checkbox"/> BOULDERS [1]	<input type="checkbox"/> OXBOWS, BACKWATERS [1] <input type="checkbox"/> AQUATIC MACROPHYTES [1] <input type="checkbox"/> LOGS OR WOODY DEBRIS [1]	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 	<div style="border: 1px solid black; width: 40px; height: 40px; margin: 0 auto;"></div> <p style="text-align: center;">Cover Maximum 20</p>		
% Amount	% Amount	% Amount	% Amount	% Amount	% Amount																		
<input type="checkbox"/> UNDERCUT BANKS [1] <input type="checkbox"/> OVERHANGING VEGETATION [1] <input type="checkbox"/> SHALLOWS (IN SLOW WATER) [1] <input type="checkbox"/> ROOTMATS [1]	<input type="checkbox"/> POOLS > 70m [2] <input type="checkbox"/> ROOTWADS [1] <input type="checkbox"/> BOULDERS [1]	<input type="checkbox"/> OXBOWS, BACKWATERS [1] <input type="checkbox"/> AQUATIC MACROPHYTES [1] <input type="checkbox"/> LOGS OR WOODY DEBRIS [1]	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 	<div style="border: 1px solid black; width: 40px; height: 40px; margin: 0 auto;"></div> <p style="text-align: center;">Cover Maximum 20</p>																		
<p>Comments</p>																							
<p>3) CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average)</p> <table style="width:100%;"> <tr> <th style="width:15%;">SINUOSITY</th> <th style="width:15%;">DEVELOPMENT</th> <th style="width:15%;">CHANNELIZATION</th> <th style="width:15%;">STABILITY</th> </tr> <tr> <td> <input type="checkbox"/> HIGH [4] <input type="checkbox"/> MODERATE [3] <input type="checkbox"/> LOW [2] <input type="checkbox"/> NONE [1] </td> <td> <input type="checkbox"/> EXCELLENT [7] <input type="checkbox"/> GOOD [5] <input type="checkbox"/> FAIR [3] <input type="checkbox"/> POOR [1] </td> <td> <input type="checkbox"/> NONE [6] <input type="checkbox"/> RECOVERED [4] <input type="checkbox"/> RECOVERING [3] <input type="checkbox"/> RECENT OR NO RECOVERY [1] </td> <td> <input type="checkbox"/> HIGH [3] <input type="checkbox"/> MODERATE [2] <input type="checkbox"/> LOW [1] </td> </tr> </table> <div style="text-align: right;"> <div style="border: 1px solid black; width: 40px; height: 40px; margin: 0 auto;"></div> <p style="text-align: center;">Channel Maximum 20</p> </div>										SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	<input type="checkbox"/> HIGH [4] <input type="checkbox"/> MODERATE [3] <input type="checkbox"/> LOW [2] <input type="checkbox"/> NONE [1]	<input type="checkbox"/> EXCELLENT [7] <input type="checkbox"/> GOOD [5] <input type="checkbox"/> FAIR [3] <input type="checkbox"/> POOR [1]	<input type="checkbox"/> NONE [6] <input type="checkbox"/> RECOVERED [4] <input type="checkbox"/> RECOVERING [3] <input type="checkbox"/> RECENT OR NO RECOVERY [1]	<input type="checkbox"/> HIGH [3] <input type="checkbox"/> MODERATE [2] <input type="checkbox"/> LOW [1]						
SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY																				
<input type="checkbox"/> HIGH [4] <input type="checkbox"/> MODERATE [3] <input type="checkbox"/> LOW [2] <input type="checkbox"/> NONE [1]	<input type="checkbox"/> EXCELLENT [7] <input type="checkbox"/> GOOD [5] <input type="checkbox"/> FAIR [3] <input type="checkbox"/> POOR [1]	<input type="checkbox"/> NONE [6] <input type="checkbox"/> RECOVERED [4] <input type="checkbox"/> RECOVERING [3] <input type="checkbox"/> RECENT OR NO RECOVERY [1]	<input type="checkbox"/> HIGH [3] <input type="checkbox"/> MODERATE [2] <input type="checkbox"/> LOW [1]																				
<p>Comments</p>																							
<p>4) BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average)</p> <table style="width:100%;"> <tr> <th style="width:15%;">River right looking downstream</th> <th style="width:15%;">L R</th> <th style="width:15%;">RIPARIAN WIDTH</th> <th style="width:15%;">L R</th> <th style="width:15%;">FLOOD PLAIN QUALITY</th> <th style="width:15%;">L R</th> </tr> <tr> <td> <input type="checkbox"/> EROSION <input type="checkbox"/> NONE/LITTLE [3] <input type="checkbox"/> MODERATE [2] <input type="checkbox"/> HEAVY/SEVERE [1] </td> <td> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </td> <td> <input type="checkbox"/> WIDE > 50m [4] <input type="checkbox"/> MODERATE 10-50m [3] <input type="checkbox"/> NARROW 5-10m [2] <input type="checkbox"/> VERY NARROW [1] <input type="checkbox"/> NONE [0] </td> <td> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </td> <td> <input type="checkbox"/> FOREST, SWAMP [3] <input type="checkbox"/> SHRUB OR OLD FIELD [2] <input type="checkbox"/> RESIDENTIAL, PARK, NEW FIELD [1] <input type="checkbox"/> FENCED PASTURE [1] <input type="checkbox"/> OPEN PASTURE, ROW CROP [0] </td> <td> <input type="checkbox"/> CONSERVATION TILLAGE [1] <input type="checkbox"/> URBAN OR INDUSTRIAL [0] <input type="checkbox"/> MINING/CONSTRUCTION [0] </td> </tr> </table> <p style="text-align: right;"> Indicate predominant land use(s) past 100m riparian. <div style="border: 1px solid black; width: 40px; height: 40px; margin: 0 auto;"></div> <p style="text-align: center;">Riparian Maximum 10</p> </p>										River right looking downstream	L R	RIPARIAN WIDTH	L R	FLOOD PLAIN QUALITY	L R	<input type="checkbox"/> EROSION <input type="checkbox"/> NONE/LITTLE [3] <input type="checkbox"/> MODERATE [2] <input type="checkbox"/> HEAVY/SEVERE [1]	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 	<input type="checkbox"/> WIDE > 50m [4] <input type="checkbox"/> MODERATE 10-50m [3] <input type="checkbox"/> NARROW 5-10m [2] <input type="checkbox"/> VERY NARROW [1] <input type="checkbox"/> NONE [0]	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 	<input type="checkbox"/> FOREST, SWAMP [3] <input type="checkbox"/> SHRUB OR OLD FIELD [2] <input type="checkbox"/> RESIDENTIAL, PARK, NEW FIELD [1] <input type="checkbox"/> FENCED PASTURE [1] <input type="checkbox"/> OPEN PASTURE, ROW CROP [0]	<input type="checkbox"/> CONSERVATION TILLAGE [1] <input type="checkbox"/> URBAN OR INDUSTRIAL [0] <input type="checkbox"/> MINING/CONSTRUCTION [0]		
River right looking downstream	L R	RIPARIAN WIDTH	L R	FLOOD PLAIN QUALITY	L R																		
<input type="checkbox"/> EROSION <input type="checkbox"/> NONE/LITTLE [3] <input type="checkbox"/> MODERATE [2] <input type="checkbox"/> HEAVY/SEVERE [1]	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 	<input type="checkbox"/> WIDE > 50m [4] <input type="checkbox"/> MODERATE 10-50m [3] <input type="checkbox"/> NARROW 5-10m [2] <input type="checkbox"/> VERY NARROW [1] <input type="checkbox"/> NONE [0]	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 	<input type="checkbox"/> FOREST, SWAMP [3] <input type="checkbox"/> SHRUB OR OLD FIELD [2] <input type="checkbox"/> RESIDENTIAL, PARK, NEW FIELD [1] <input type="checkbox"/> FENCED PASTURE [1] <input type="checkbox"/> OPEN PASTURE, ROW CROP [0]	<input type="checkbox"/> CONSERVATION TILLAGE [1] <input type="checkbox"/> URBAN OR INDUSTRIAL [0] <input type="checkbox"/> MINING/CONSTRUCTION [0]																		
<p>Comments</p>																							
<p>5) POOL/GLIDE AND RIFFLE/RUN QUALITY</p> <table style="width:100%;"> <tr> <th style="width:15%;">MAXIMUM DEPTH</th> <th style="width:15%;">CHANNEL WIDTH</th> <th style="width:15%;">CURRENT VELOCITY</th> <th style="width:15%;">Recreation Potential</th> </tr> <tr> <td> Check ONE (ONLY!) <input type="checkbox"/> > 1m [6] <input type="checkbox"/> 0.7 - < 1m [4] <input type="checkbox"/> 0.4 - < 0.7m [2] <input type="checkbox"/> 0.2 - < 0.4m [1] <input type="checkbox"/> < 0.2m [0] [metric = 0] </td> <td> Check ONE (Or 2 & average) <input type="checkbox"/> POOL WIDTH > RIFFLE WIDTH [2] <input type="checkbox"/> POOL WIDTH = RIFFLE WIDTH [1] <input type="checkbox"/> POOL WIDTH < RIFFLE WIDTH [0] </td> <td> Check ALL that apply <input type="checkbox"/> TORRENTIAL [-1] <input type="checkbox"/> VERY FAST [1] <input type="checkbox"/> FAST [1] <input type="checkbox"/> MODERATE [1] </td> <td> <input type="checkbox"/> SLOW [1] <input type="checkbox"/> INTERSTITIAL [-1] <input type="checkbox"/> INTERMITTENT [-2] <input type="checkbox"/> EDDIES [1] </td> </tr> </table> <p>Indicate for reach - pools and riffles.</p> <div style="text-align: right;"> <div style="border: 1px solid black; width: 40px; height: 40px; margin: 0 auto;"></div> <p style="text-align: center;">Pool/ Current Maximum 12</p> </div>										MAXIMUM DEPTH	CHANNEL WIDTH	CURRENT VELOCITY	Recreation Potential	Check ONE (ONLY!) <input type="checkbox"/> > 1m [6] <input type="checkbox"/> 0.7 - < 1m [4] <input type="checkbox"/> 0.4 - < 0.7m [2] <input type="checkbox"/> 0.2 - < 0.4m [1] <input type="checkbox"/> < 0.2m [0] [metric = 0]	Check ONE (Or 2 & average) <input type="checkbox"/> POOL WIDTH > RIFFLE WIDTH [2] <input type="checkbox"/> POOL WIDTH = RIFFLE WIDTH [1] <input type="checkbox"/> POOL WIDTH < RIFFLE WIDTH [0]	Check ALL that apply <input type="checkbox"/> TORRENTIAL [-1] <input type="checkbox"/> VERY FAST [1] <input type="checkbox"/> FAST [1] <input type="checkbox"/> MODERATE [1]	<input type="checkbox"/> SLOW [1] <input type="checkbox"/> INTERSTITIAL [-1] <input type="checkbox"/> INTERMITTENT [-2] <input type="checkbox"/> EDDIES [1]						
MAXIMUM DEPTH	CHANNEL WIDTH	CURRENT VELOCITY	Recreation Potential																				
Check ONE (ONLY!) <input type="checkbox"/> > 1m [6] <input type="checkbox"/> 0.7 - < 1m [4] <input type="checkbox"/> 0.4 - < 0.7m [2] <input type="checkbox"/> 0.2 - < 0.4m [1] <input type="checkbox"/> < 0.2m [0] [metric = 0]	Check ONE (Or 2 & average) <input type="checkbox"/> POOL WIDTH > RIFFLE WIDTH [2] <input type="checkbox"/> POOL WIDTH = RIFFLE WIDTH [1] <input type="checkbox"/> POOL WIDTH < RIFFLE WIDTH [0]	Check ALL that apply <input type="checkbox"/> TORRENTIAL [-1] <input type="checkbox"/> VERY FAST [1] <input type="checkbox"/> FAST [1] <input type="checkbox"/> MODERATE [1]	<input type="checkbox"/> SLOW [1] <input type="checkbox"/> INTERSTITIAL [-1] <input type="checkbox"/> INTERMITTENT [-2] <input type="checkbox"/> EDDIES [1]																				
<p>Comments</p>																							
<p>Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:</p> <table style="width:100%;"> <tr> <th style="width:15%;">RIFFLE DEPTH</th> <th style="width:15%;">RUN DEPTH</th> <th style="width:15%;">RIFFLE/RUN SUBSTRATE</th> <th style="width:15%;">RIFFLE/RUN EMBEDDEDNESS</th> </tr> <tr> <td> <input type="checkbox"/> BEST AREAS > 10cm [2] <input type="checkbox"/> BEST AREAS 5 - 10cm [1] <input type="checkbox"/> BEST AREAS < 5cm [metric = 0] </td> <td> <input type="checkbox"/> MAXIMUM > 50cm [2] <input type="checkbox"/> MAXIMUM < 50cm [1] </td> <td> <input type="checkbox"/> STABLE (e.g., Cobble, Boulder) [2] <input type="checkbox"/> MOD. STABLE (e.g., Large Gravel) [1] <input type="checkbox"/> UNSTABLE (e.g., Fine Gravel, Sand) [0] </td> <td> <input type="checkbox"/> NONE [2] <input type="checkbox"/> LOW [1] <input type="checkbox"/> MODERATE [0] <input type="checkbox"/> EXTENSIVE [-1] </td> </tr> </table> <div style="text-align: right;"> <div style="border: 1px solid black; width: 40px; height: 40px; margin: 0 auto;"></div> <p style="text-align: center;">Riffle/ Run Maximum 8</p> </div>										RIFFLE DEPTH	RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN EMBEDDEDNESS	<input type="checkbox"/> BEST AREAS > 10cm [2] <input type="checkbox"/> BEST AREAS 5 - 10cm [1] <input type="checkbox"/> BEST AREAS < 5cm [metric = 0]	<input type="checkbox"/> MAXIMUM > 50cm [2] <input type="checkbox"/> MAXIMUM < 50cm [1]	<input type="checkbox"/> STABLE (e.g., Cobble, Boulder) [2] <input type="checkbox"/> MOD. STABLE (e.g., Large Gravel) [1] <input type="checkbox"/> UNSTABLE (e.g., Fine Gravel, Sand) [0]	<input type="checkbox"/> NONE [2] <input type="checkbox"/> LOW [1] <input type="checkbox"/> MODERATE [0] <input type="checkbox"/> EXTENSIVE [-1]						
RIFFLE DEPTH	RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN EMBEDDEDNESS																				
<input type="checkbox"/> BEST AREAS > 10cm [2] <input type="checkbox"/> BEST AREAS 5 - 10cm [1] <input type="checkbox"/> BEST AREAS < 5cm [metric = 0]	<input type="checkbox"/> MAXIMUM > 50cm [2] <input type="checkbox"/> MAXIMUM < 50cm [1]	<input type="checkbox"/> STABLE (e.g., Cobble, Boulder) [2] <input type="checkbox"/> MOD. STABLE (e.g., Large Gravel) [1] <input type="checkbox"/> UNSTABLE (e.g., Fine Gravel, Sand) [0]	<input type="checkbox"/> NONE [2] <input type="checkbox"/> LOW [1] <input type="checkbox"/> MODERATE [0] <input type="checkbox"/> EXTENSIVE [-1]																				
<p>Comments</p>																							
<p>6) GRADIENT (ft/mi) <input type="checkbox"/> VERY LOW - LOW [2-4] <input type="checkbox"/> MODERATE [6-10] <input type="checkbox"/> HIGH - VERY HIGH [10-6]</p> <p>DRAINAGE AREA (mi²) <input type="checkbox"/> VERY LOW - LOW [2-4] <input type="checkbox"/> MODERATE [6-10] <input type="checkbox"/> HIGH - VERY HIGH [10-6]</p> <div style="text-align: right;"> <div style="border: 1px solid black; width: 40px; height: 40px; margin: 0 auto;"></div> <p style="text-align: center;">Gradient Maximum 10</p> </div>																							

IDEM 11/15/12

Blank OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index) Form (back)



OWQ Biological QHEI (Qualitative Habitat Evaluation Index)

COMMENT _____

A-CANOPY

- ☐ > 85% - Open
- ☐ 55% - < 85%
- ☐ 30% - < 55%
- ☐ 10% - < 30%
- ☐ < 10% - Closed

B-AESTHETICS

- ☐ Nuisance algae
- ☐ Invasive macrophytes
- ☐ Excess turbidity
- ☐ Discoloration
- ☐ Foam/Scum
- ☐ Oil/sheen
- ☐ Trash/Litter
- ☐ Nuisance odor
- ☐ Sludge deposits
- ☐ CSDs/SSDs/Outfalls

C-RECREATION

- Area Depth
 Pool ☐ > 100 ft² ☐ > 3 ft

D-MAINTENANCE

- ☐ Public ☐ Private
- ☐ Active ☐ Historic
- Successions: ☐ Young ☐ Old
- ☐ Spray ☐ Islands ☐ Scoured
- Snag: ☐ Removed ☐ Modified
- Leveed: ☐ One sided ☐ Both banks
- ☐ Relocated ☐ Cutoffs
- Bedload: ☐ Moving ☐ Stable
- ☐ Armoured ☐ Slumps
- ☐ Impounded ☐ Desiccated
- ☐ Flood control ☐ Drainage

E-ISSUES

- ☐ WWTP ☐ CSD ☐ NPDES
- ☐ Industry ☐ Urban
- ☐ Hardened ☐ Dirt & Grime
- ☐ Contaminated ☐ Landfill
- BMPs: ☐ Construction ☐ Sediment
- ☐ Logging ☐ Irrigation ☐ Cooling
- Erosion: ☐ Bank ☐ Surface
- ☐ False bank ☐ Manure ☐ Lagoon
- ☐ Wash H₂O ☐ Tile ☐ H₂O Table
- Mines: ☐ Acid ☐ Quarry
- Flow: ☐ Natural ☐ Stagnant
- ☐ Wetland ☐ Park ☐ Golf
- ☐ Lawn ☐ Home
- ☐ Atmospheric deposition
- ☐ Agriculture ☐ Livestock

Looking upstream (> 10m, 3 readings; ≤ 10m, 1 reading in middle); Round to the nearest whole percent

	Right	Middle	Left	Total Average
% open	%	%	%	%
	X	X	X	

Stream Drawing: _____

Attachment 4: Macroinvertebrate Header Form



Office of Water Quality: Macroinvertebrate Header

L-Site #	Event ID	Stream Name	Location	County	Surveyor

Sample Date	Sample #	Macro#	# Containers

Macro Sample Type:	
<input type="checkbox"/> Black Light	<input type="checkbox"/> Kick
<input type="checkbox"/> CPOM	<input type="checkbox"/> MHAB
<input type="checkbox"/> Hester-Dendy	<input type="checkbox"/> Qualitative

<input type="checkbox"/> Normal	_____
<input type="checkbox"/> Duplicate	_____
<input type="checkbox"/> Replicate	_____

☐ Habitat Complete ☐ Sample Quality Rejected

Riparian Zone/Instream Features

Watershed Erosion:	Watershed NPS Pollution:
<input type="checkbox"/> Heavy <input type="checkbox"/> Moderate <input type="checkbox"/> None	<input type="checkbox"/> No Evidence <input type="checkbox"/> Obvious Sources <input type="checkbox"/> Some Potential Sources

Stream Depth Riffle (m):	Stream Depth Run (m):	Stream Depth Pool (m):	Distances Riffle-Riffle (m):	Distances Bend-Bend (m):

Stream Width (m):	High Water Mark (m):	Velocity (ft/s):

Stream Type:	Turbidity (Est):	Salinity (mg/L):	ORP (mV):
<input type="checkbox"/> Cold <input type="checkbox"/> Warm	<input type="checkbox"/> Clear <input type="checkbox"/> Slightly Turbid <input type="checkbox"/> Opaque <input type="checkbox"/> Turbid		

☐ Channelization ☐ Dam Present

Predominant Surrounding Land Use: ☐ Forest ☐ Field/Pasture ☐ Agricultural ☐ Residential ☐ Commercial ☐ Industrial
 Other _____

Sediment

Sediment Odors: ☐ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None Other _____

Sediment Deposits: ☐ Sludge ☐ Sawdust ☐ Paper Fiber ☐ Sand ☐ Relic Shells Other _____

Sediment Oils: ☐ Absent ☐ Moderate ☐ Profuse ☐ Slight

☐ Are the undersides of stones, which are not deeply embedded, black?

Substrate Components

(Note: Select from 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, or 100% for each inorganic/ organic substrate component)

Inorganic Substrate Components (% Diameter)						Organic Substrate Components (% Type)			
Bedrock	Boulder (>10 in)	Cobble (2.5-10 in)	Gravel (0.1-2.5 in)	Sand (gritty)	Silt (silt)	Detritus (sticks, wood)	Detritus (CPOM)	Muck/Mud (black, fine FPOM)	Marl(gray w/ shell fragments)

Water Quality

Water Odors: ☐ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ None Other _____

Water Surface Oils: ☐ Slick ☐ Sheen ☐ Glob ☐ Flocks ☐ None

IDEM 03/14/13

Attachment 5: Fish Collection Data Sheet



Fish Collection Data Sheet

Analysis Set #	Rank

Sample #:		Stream Name:		EPA Site ID:	
Site #:		Site Description:			
EventID	Equipment Used	Voltage	Time At Site (hh:mm)	Time Fished (sec)	Distance Fished (m)
					Water Depth (m) Max. Avg.
Avg. Stream Width (m)		Voucher Jars	Unknown Jars	Bridge In Reach?	Is Reach Representative?
				<input type="checkbox"/>	<input type="checkbox"/>
		Why is Reach Not Representative?		Special Comments	
				Initials ID Date	
				Jar Count Fish Total	

Coding for Anomalies:

D - deformities; E - eroded fins; L - lesion; T - tumor; M - multiple DELT anomalies; AW - anchor worm; LE - leeches; SS - scaled scales; PO - popeye; EM - emaciated; FU - fungus; PA - parasites

Species		Physical Characteristics				Anomalies						
		Weight (g)				D	E	L	T	M	AW	LE
Fish Detail#:		Total	Min	Max	Mean							
Museum Total	Total Fish	Length (mm)		Age (yrs)		SS	PO	EM	FU	PA	Other Anomaly	
		Min	Max	Mean	Min	Max						
Species		Physical Characteristics				Anomalies						
		Weight (g)				D	E	L	T	M	AW	LE
Fish Detail#:		Total	Min	Max	Mean							
Museum Total	Total Fish	Length (mm)		Age (yrs)		SS	PO	EM	FU	PA	Other Anomaly	
		Min	Max	Mean	Min	Max						
Species		Physical Characteristics				Anomalies						
		Weight (g)				D	E	L	T	M	AW	LE
Fish Detail#:		Total	Min	Max	Mean							
Museum Total	Total Fish	Length (mm)		Age (yrs)		SS	PO	EM	FU	PA	Other Anomaly	
		Min	Max	Mean	Min	Max						
Species		Physical Characteristics				Anomalies						
		Weight (g)				D	E	L	T	M	AW	LE
Fish Detail#:		Total	Min	Max	Mean							
Museum Total	Total Fish	Length (mm)		Age (yrs)		SS	PO	EM	FU	PA	Other Anomaly	
		Min	Max	Mean	Min	Max						
Species		Physical Characteristics				Anomalies						
		Weight (g)				D	E	L	T	M	AW	LE
Fish Detail#:		Total	Min	Max	Mean							
Museum Total	Total Fish	Length (mm)		Age (yrs)		SS	PO	EM	FU	PA	Other Anomaly	
		Min	Max	Mean	Min	Max						
Species		Physical Characteristics				Anomalies						
		Weight (g)				D	E	L	T	M	AW	LE
Fish Detail#:		Total	Min	Max	Mean							
Museum Total	Total Fish	Length (mm)		Age (yrs)		SS	PO	EM	FU	PA	Other Anomaly	
		Min	Max	Mean	Min	Max						
Species		Physical Characteristics				Anomalies						
		Weight (g)				D	E	L	T	M	AW	LE
Fish Detail#:		Total	Min	Max	Mean							
Museum Total	Total Fish	Length (mm)		Age (yrs)		SS	PO	EM	FU	PA	Other Anomaly	
		Min	Max	Mean	Min	Max						

OWQ Assessment Branch Biological Studies Section: Fish Collection Data Sheet,

Attachment 6: Chain of Custody Form

Indiana Department of Environmental Management OWQ Chain of Custody Form		Project: _____	
		Team: _____	
OWQ Analysis Set: _____		Date: _____	

I certify that the sample(s) listed below was/were collected by me, or in my presence. Date: _____

Signature: _____ Section: _____

Lab Assigned Number	IDEM Control Number	Sample Type	ID	1000 ml P, N, M.	1000 ml G, N, M.	500 ml G, N, M.	120 ml G (Bact)	500 ml P, N, M.	250 ml P, N, M.	Date And Time Collected	
										Date	Time

P = Plastic G = Glass N. M. = Narrow Mouth Bact = Bacteriological Only Should samples be iced? **Y** **N**

Carriers

I certify that I have received the above sample(s).

Signature	Date	Time	Seals Intact		Comments
Relinquished By: _____			Y	N	
Received By: _____					
Relinquished By: _____			Y	N	
Received By: _____					
Relinquished By: _____			Y	N	
Received By: _____					

Lab Custodian

I certify that I have received the above sample(s), which has/have been recorded in the official record book. The same sample(s) will be in the custody of competent laboratory personnel at all times, or locked in a secured area.

Signature: _____ Date: _____ Time: _____

Lab: _____ Address: _____

04/17/2003 12:31:20 PM
04/17/2003 12:31:20 PM Fixed Station Chain of Custody Datasheet, Page 1 of 1

Attachment 7: Sample Analysis Request Form



Indiana Department of Environmental Management
Office of Water Quality
Watershed Planning and Assessment Branch
www.idem.IN.gov

Water Sample Analysis Request

Project Name: 2013 Whitewater River Baseline Composite ☐ Grab ☒

OWQ Sample Set	13BLW	IDEM Sample Nos.	
Crew Chief		Lab Sample Nos.	
Collection Date		Lab Delivery Date	

Anions and Physical Parameters			
Parameter	Test Method	Total	Dissolved
Alkalinity (as CaCO ₃)	EPA 310.2	<input checked="" type="checkbox"/> **	<input type="checkbox"/>
Total Solids	SM 2540B	<input checked="" type="checkbox"/> **	
Suspended Solids	SM 2540D	<input checked="" type="checkbox"/> **	
Dissolved Solids	SM 2540C		<input checked="" type="checkbox"/> **
Sulfate	EPA 375.2	<input checked="" type="checkbox"/> **	<input type="checkbox"/> **
Chloride	SM 4500Cl-E	<input checked="" type="checkbox"/> **	<input type="checkbox"/>
Hardness (as CaCO ₃)	EPA 130.1	<input checked="" type="checkbox"/> **	<input type="checkbox"/>
Fluoride	380-75WE	<input type="checkbox"/> **	<input type="checkbox"/>
Silica (Reactive)	SM 4500-SiD	<input type="checkbox"/> **	<input type="checkbox"/>

Priority Pollutant Metals Water Parameters			
Parameter	Test Method	Total	Dissolved
Antimony	200.8	<input type="checkbox"/>	<input type="checkbox"/>
Arsenic	200.8	<input type="checkbox"/>	<input type="checkbox"/>
Beryllium	200.8	<input type="checkbox"/>	<input type="checkbox"/>
Cadmium	200.8	<input type="checkbox"/>	<input type="checkbox"/>
Chromium (Hex)	SM 3500Cr-D	<input type="checkbox"/>	<input type="checkbox"/>
Chromium (Total)	200.8	<input type="checkbox"/>	<input type="checkbox"/>
Copper	200.8	<input type="checkbox"/>	<input type="checkbox"/>
Lead	200.8	<input type="checkbox"/>	<input type="checkbox"/>
Mercury	EPA 245.1	<input type="checkbox"/>	<input type="checkbox"/>
Nickel	200.8	<input type="checkbox"/>	<input type="checkbox"/>
Selenium	200.8	<input type="checkbox"/>	<input type="checkbox"/>
Silver	200.8	<input type="checkbox"/>	<input type="checkbox"/>
Thallium	200.8	<input type="checkbox"/>	<input type="checkbox"/>
Zinc	200.7	<input type="checkbox"/>	<input type="checkbox"/>

Cations and Secondary Metals Parameters			
Parameter	Test Method	Total	Dissolved
Aluminum	200.7, 200.8	<input type="checkbox"/>	<input type="checkbox"/>
Barium	200.8	<input type="checkbox"/>	<input type="checkbox"/>
Boron	200.8	<input type="checkbox"/>	<input type="checkbox"/>
Calcium	200.7, 200.8	<input type="checkbox"/> ***	<input type="checkbox"/>
Calcium (as CaCO ₃)	SM 3500Ca-D	<input type="checkbox"/>	<input type="checkbox"/>
Cobalt	200.8	<input type="checkbox"/>	<input type="checkbox"/>
Iron	200.7	<input type="checkbox"/>	<input type="checkbox"/>
Magnesium	200.7, 200.8	<input type="checkbox"/> ***	<input type="checkbox"/>
Manganese	200.8	<input type="checkbox"/>	<input type="checkbox"/>
Potassium	SM 3500-K D	<input type="checkbox"/>	<input type="checkbox"/>
Sodium	200.7	<input type="checkbox"/>	<input type="checkbox"/>
Strontium	200.7	<input type="checkbox"/>	<input type="checkbox"/>

Send reports (Fed. Ex. or UPS) to: David Jordan - IDEM
Mail Code 65-40-2 (Shadeland)
100 N. Senate Ave.
Indianapolis, IN 46204-2251

Deliver reports to: David Jordan - IDEM
STE 100
2525 North Shadeland Ave.
Indianapolis, IN 46219
DJordan@idem.in.gov

Organic Water Parameters		
Parameter	Test Method	Total
Priority Pollutants: Oranochlorine Pesticides and PCBs	EPA 608	<input type="checkbox"/>
Polynuclear Aromatic Hydrocarbons	EPA 610	<input type="checkbox"/>
Priority Pollutants: VOCs - Purgeable Organics	EPA 624	<input type="checkbox"/>
Priority Pollutants: Base/Neutral Extractables	EPA 625	<input type="checkbox"/>
Priority Pollutants: Acid Extractables	EPA 625	<input type="checkbox"/>
Phenolics, 4AAP	EPA 420.4	<input type="checkbox"/>
Oil and Grease, Total	EPA 1664A	<input type="checkbox"/>
Semi-volatile Organics & Pesticides	EPA 525.2	<input type="checkbox"/>

Nutrient & Organic Water Chemistry Parameters			
Parameter	Test Method	Total	Dissolved
Ammonia Nitrogen	EPA 350.1	<input checked="" type="checkbox"/>	<input type="checkbox"/>
CBOD ₅	SM 5210B	<input type="checkbox"/>	
CBOD _U	SM 5210B	<input type="checkbox"/>	
Total Kjeldahl Nitrogen (TKN)	EPA 351.2	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Nitrate + Nitrite	EPA 353.1	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Total Phosphorus	EPA 365.1	<input checked="" type="checkbox"/>	<input type="checkbox"/>
TOC	SM 5310B	<input checked="" type="checkbox"/>	<input type="checkbox"/>
COD (Low Level)	SM 5220D	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Cyanide (Total)	EPA 335.4	<input type="checkbox"/>	<input type="checkbox"/>
Cyanide (Free)	SM 4500CN-I	<input type="checkbox"/> *	<input type="checkbox"/>
Cyanide (Amenable)	SM 4500CN-G	<input type="checkbox"/> *	<input type="checkbox"/>

Bacteriological Water Parameters			
Parameter	Test Method	Total	Dissolved
<i>E. coli</i> (Colilert Method)	SM9223B	<input type="checkbox"/>	

30 day reporting time required.

Notes:

** = DO NOT RUN PARAMETER IF SAMPLE IDENTIFIED AS A BLANK ON THE CHAIN OF CUSTODY

* = RUN ONLY IF TOTAL CYANIDE IS DETECTED

*** = Report Calcium, Magnesium as Total Hardness components if Hardness is calculated

Testing Laboratory:
Indiana State Department of Health (ISDH)
Environmental Laboratory Division
550 W. 16th Street
Indianapolis, IN 46202
Phone: 317-921-5815 (Ray Beebe) (Rev. 9/2013)

BIOLOGICAL STUDIES SECTION

I certify that the sample(s) listed below was/were collected by me or in my presence.

Date: / /

Signature:

Sample Type:

(ie, fish, macro, algae)

44